

Borehole Data Package for Calendar Year 2001 RCRA Wells at Single-Shell Tank Waste Management Area U

D. G. Horton

March 2002



Prepared for the U.S. Department of Energy under Contract DE-AC06-76RL01830

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> PACIFIC NORTHWEST NATIONAL LABORATORY operated by BATTELLE for the UNITED STATES DEPARTMENT OF ENERGY under Contract DE-AC06-76RL01830



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Pacific Northwest National Laboratory Richland, Washington 99352

Summary

This document is a compilation of the information on well drilling and construction, well development, pump installation, and sediment sampling at three new RCRA wells (299-W-18-40, 299-W19-44, and 299-W19-45) constructed at Waste Management Area U in September 2001. These wells were constructed to the specifications and requirements described in Washington Administrative Codes 173-160 and 173-303.

Grab samples for geological description and archive were collected every 5 ft throughout the wells. Borehole and drill cuttings were monitored regularly for organic vapors and radionuclide contaminants.

At well 299-W18-40, beta-gamma activity was found to be slightly above background at 120 ft below ground surface. All other measurements were below background. Cesium-137 was found at the ground surface and at 3 ft below ground surface (bgs). No other manmade contamination was found.

At well 299-W19-44, no radionuclide contamination was found, but several intervals of high carbon monoxide were detected. Cesium-137 was detected at 3 ft bgs at 0.4 pCi/g.

At well 299-W19-45, no radionuclide contamination was found, but several intervals of high carbon monoxide were detected. Cesium-137 was detected near the surface at 0.4 pCi/g. No other manmade radionuclide was detected.

At well 299-W19-45, samples for geological description and archive were collected every 5 ft throughout the well. No contamination was noted. Cesium-137 was detected near the surface at 0.4 to 1.4 pCi/g. No other manmade radionuclide was detected.

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1.0 Introduction

Three new *Resource Conservation and Recovery Act* (RCRA) groundwater monitoring wells were installed at the single-shell tank farm Waste Management Area (WMA) U in August and September 2001 in partial fulfillment of Tri-Party Agreement (Ecology et al. 1998) milestone M-24-00M. The wells are 299-W18-40, 299-W19-44, and 299-W19-45. Table 1 correlates the well name with the well number. Well 299-W18-40 is located outside the southwest corner of 241-U tank farm and is a new upgradient well in the monitoring network. Wells 299-W19-44 and 299-W19-45 are new downgradient wells located east of the 241-U tank farm. The locations of all wells in the WMA U monitoring network are shown on Figure 1.

The groundwater quality assessment plan for WMA U was issued in 2001 and calls for the installation of five new wells (Smith et al. 2001). The three wells installed in 2001 are part of those described in the assessment plan. The new wells were constructed to the specifications and requirements described in Washington Administrative Codes 173-160 and 173-303, the assessment plan for WMA U (Smith et al. 2001), and the description of work for well drilling and construction.¹

This document compiles information on the drilling and construction, well development, pump installation, and sediment sampling applicable to the installation of the three new wells. Appendix A contains the Well Summary Sheets (as-built diagrams), the Well Construction Summary Reports, and the geologist's logs; Appendix B contains results of physical properties testing; and Appendix C contains borehole geophysical logs. Additional documentation concerning well construction is on file with Bechtel Hanford, Inc., Richland, Washington.

English units are used in this report because that is the system of units used by drillers to measure and report depths and well construction details. The information below can be used for conversion to metric units:

- 1 foot (ft) = 0.3048 meter
- 1 inch (in.) = 2.54 centimeters
- 1 gallon (gal) = 3.785 liters

Table 1. Well Names and Well Numbers for Wells Drilled at Waste Management Area U During Calendar Year 2001

Well Name	Well Number
299-W18-40	C3395
299-W19-44	C3393
299-W19-45	C3394

¹ Letter from J. S. Fruchter (Pacific Northwest National Laboratory) to G. B. Mitchem (Bechtel Hanford Inc.) *Description of Work for Drilling of CY 2001 RCRA Groundwater Monitoring Wells*, dated April 16, 2001.

1

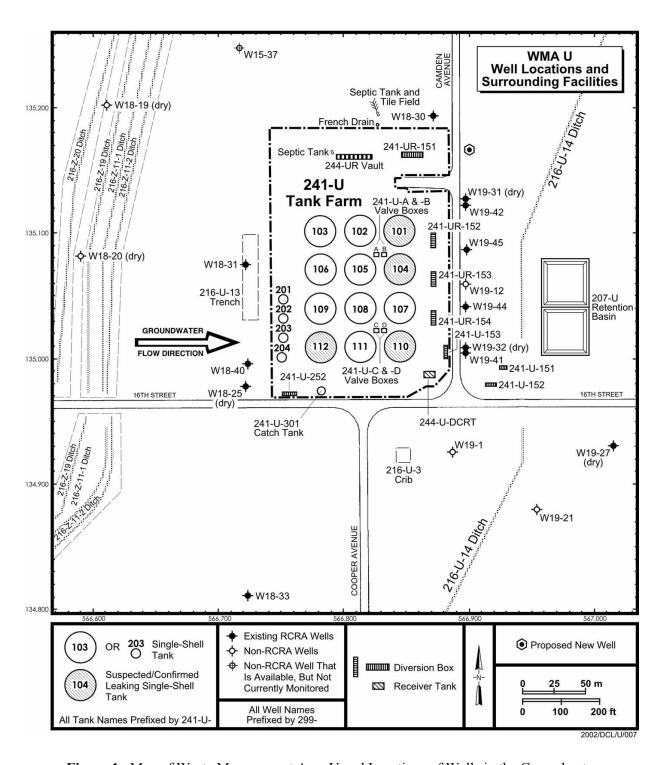


Figure 1. Map of Waste Management Area U and Locations of Wells in the Groundwater Monitoring Network

2.0 Well 299-W18-40

2.1 Drilling and Sampling

Well 299-W18-40 was drilled in August and September 2001. The borehole was advanced with a cable tool rig and drive barrel from the surface to 147 ft below ground surface (bgs). An air rotary drill rig was used from 147 to 178 ft bgs and a cable tool rig with hard tool from 178 ft to total depth of 260 ft bgs. Temporary 10-3/4-in.-outside-diameter, carbon steel casing was used for the entire depth. An unknown amount of water was pumped into the borehole at about 178 ft bgs to unstick the drill bit. Approximately 255 gal of water were added to the borehole during hard tool drilling.

The sediments encountered during drilling were eolian silty sand from the surface to about 10 ft bgs and Hanford formation sandy gravel and silty sandy gravel from 10 to ~69 ft bgs and sand with minor silty sand and sandy silt from 69 to 116 ft bgs. Sandy silt of the upper Plio-Pliestocene unit exists from about 116 to 133 ft bgs and the lower Plio-Pleistocene silty sandy gravel with caliche from 133 to 137 ft bgs. Sandy gravels and silty sandy gravels of the Ringold Formation member of Wooded Island, unit E exists from 137 ft to the bottom of the borehole at 260 ft bgs. The geologist's log is included in Appendix A.

Grab samples for geologic description and archive were collected every 5 ft throughout the borehole. Also, two split spoon samples were taken from 220 to 222.5 ft and from 250 to 252.5 ft bgs for analysis of particle size distribution. Particle size distribution data are in Appendix B.

The borehole and drill cuttings were monitored regularly for organic vapors and radionuclide contaminants. Beta-gamma activity was found to be slightly above background at 120 ft bgs. All other measurements were below background. The borehole was geophysically logged with spectral gamma and neutron moisture tools. Cesium-137 was found at the ground surface and at 3 ft bgs at ≤0.2 pCi/g. No other manmade contamination was found.

2.2 Well Completion

The permanent casing and screen were installed in well 299-W18-40 in September 2001. A 4-in.-inner-diameter, stainless steel, wire wrap, 20 slot screen was set from 253.28 to 218.27 ft bgs. The permanent casing is 4-in.-inner-diameter, stainless steel from 218.27 ft bgs to 1.9 ft above ground surface. A 2-ft-long stainless steel sump is below the screen from a depth of 255.28 to 253.28 ft.

The filter pack is 10 to 20 mesh silica sand from 257.8 to 207.8 ft bgs. The annular seal is ¼ in. bentonite pellets from 207.8 to 202.0 ft bgs, granular bentonite from 202.0 ft to 11.6 ft bgs, and Portland cement grout from 11.6 ft bgs to the surface. A 4 ft by 4 ft by 6 in. concrete pad was placed around the well at the surface. A protective casing with locking cap, four protective steel posts, and a brass marker

stamped with the well number were set into the concrete. The protective casing extends 2.22 ft above the concrete pad. The Well Summary Sheet (as-built) and Well Construction Summary Report are included in Appendix A.

The vertical and horizontal coordinates of the well were surveyed in December 2001. The horizontal position of the well was determined by Global Positioning System observations referenced to horizontal control stations established by Rogers Surveying, Inc., Richland, Washington and the U.S. Army Corps of Engineers. The coordinates are Washington Coordinate System, South Zone, NAD83(91) datum. Vertical datum is NAVD 1988 and is based on existing benchmarks established by the U.S. Army Corps of Engineers. Survey data are included in Table 2 and the survey data sheet is included in Appendix A.

Well Name	Easting (m)	Northing (m)	Elevation (m)	Reference Point
	566723.29	134996.41		Center of casing
299-W18-40			203.413	"X" on rim
	566723.28	134996.72	202.735	Brass cap
	566896.95	135041.97		Center of casing
299-W19-44			207.277	"X" on rim
	566896.95	135042.26	206.520	Brass cap
	566897.65	135087.65		Center of casing
299-W19-45			206.413	"X" on rim
	566897 64	135087 88	205 661	Brass can

Table 2. Survey Data for New Wells at Waste Management Area U

2.3 Well Development and Pump Installation

Well 299-W18-40 was developed in September 2001. A temporary, submersible pump was used to remove approximately 1,067 gal of formation water at about 5 gal/min. The pump intake was at 250 ft bgs. Final drawdown was 12.1 ft and turbidity was 4.46 NTU.

A dedicated submersible sampling pump (Redi-Flo2) was installed in well 299-W18-40 in October 2001. The sampling pump was originally installed with the intake at 34.95 ft below static water level. The pump later was raised 20 ft. Static water level was 214.6 ft bgs on September 27, 2001.

3.0 Well 299-W19-44

3.1 Drilling and Sampling

Well 299-W19-44 was drilled in August and September 2001 with a cable tool drill rig from the surface to a total depth of 272.0 ft bgs. The well was advance using drive barrel and split spoon sampler from the surface to a depth of 153 ft and by hard tool from 153 ft to total depth. Temporary 11-¾-in.-outside-diameter, carbon steel casing was used from the surface to 61 ft bgs and 8-¾-in. temporary casing from the surface to total depth of 272.0 ft.

The sediments encountered during drilling were Hanford formation sandy gravel and gravelly sand from the surface to ~45 ft bgs and sand and silty sand from 45 to 130 ft bgs. Sandy silt of the upper Plio-Pleistocene exists from 130 to 144 ft bgs and lower Plio-Pleistocene silty sandy gravel with caliche from 144 to 147 ft bgs. Silty sandy gravel and sandy silty gravel of the Ringold Formation member of Wooded Island, unit E exists from 147 ft bgs to total depth. The geologist's log is included in Appendix A.

Near continuous split spoon samples were collected from the surface to 145 ft bgs for characterization of uncontaminated vadose zone sediments. Grab samples for geologic description and archive were collected every 5 ft throughout the borehole. Also, two split spoon samples were taken from 232.0 to 234.5 ft and from 267 to 269.5 ft bgs for analysis of particle size distribution. Particle size distribution data are in Appendix B.

The borehole and drill cuttings were monitored regularly for organic vapors and radionuclide contaminants. No radionuclide contamination was found by field screening methods but several intervals had relatively high carbon monoxide levels in the borehole. The borehole was geophysically logged with spectral gamma-ray and neutron moisture tools on September 4 and 5, 2001. Cesium-137 was the only manmade radionuclide identified. Cesium-137 was found at 3 ft bgs at 0.4 pCi/g.

3.2 Well Completion

The permanent casing and screen were installed in well 299-W19-44 in September 2001. A 4-in.-inner-diameter, stainless steel, wire wrap, 20 slot screen was set from 264.9 to 229.9 ft bgs. The permanent casing is 4-in.-inner-diameter, stainless steel from 229.9 ft bgs to 2.0 ft above ground surface. A 2-ft-long stainless steel sump is below the screen from 266.9 to 264.9 ft bgs.

The filter pack is 10 to 20 mesh silica sand from 272.0 to 218.9 ft bgs. The annular seal is ¼-in. bentonite pellets from 218.9 to 213.03 ft bgs, bentonite crumbles from 213.03 to 10.3 ft bgs, and Portland cement grout from 10.3 ft bgs to the surface. A 4 ft by 4 ft by 6 in. concrete pad was placed around the well at the surface. A 6-in. stainless steel protective casing with locking cap, four protective steel posts,

and a brass marker stamped with the well number were set into the concrete. The protective casing extends 2.48 ft above the concrete pad. The Well Summary Sheet (as-built) and Well Construction Summary Report are included in Appendix A.

The vertical and horizontal coordinates of the well were surveyed in December 2001. The horizontal position of the well was determined by Global Positioning System observations referenced to horizontal control stations established by Rogers Surveying, Inc., Richland, Washington and the U.S. Army Corps of Engineers. The coordinates are Washington Coordinate System, South Zone, NAD83(91) datum. Vertical datum is NAVD 1988 and is based on existing benchmarks established by the U.S. Army Corps of Engineers. Survey data are included in Table 2 and the survey data sheet is included in Appendix A.

3.3 Well Development and Pump Installation

Well 299-W19-44 was developed in September 2001. A temporary, 3 hp, submersible pump was used to remove approximately 936 gal of formation water from 263 ft bgs. Well development began at 5 gal/min but excessive drawdown (27 ft) dictated a slower pumping rate of 3 gal/min for most of the development. The final drawdown was 18.6 ft and the final turbidity was 3 NTU. The top half of the screened interval was not developed. The final turbidity was 1.81 NTU.

A dedicated, Redi Flo-2 submersible sampling pump was installed in well 299-W19-44 in September 2001. The sampling pump intake is at 255.35 ft bgs (or about 28.4 ft below the water table). Static water level was 226.96 ft bgs on September 14, 2001.

4.0 Well 299-W19-45

4.1 Drilling and Sampling

Well 299-W19-45 was drilled with a cable tool drill rig from the surface to 30 ft bgs and with air rotary rig from 30 ft to a total depth of 266.1 ft bgs during August 2001. Temporary 10-3/4-in.-outside-diameter, carbon steel casing was placed from the surface to total depth. About 75 gal of water were added at 233 ft bgs to clear cuttings from the borehole, and an unknown amount of water was added at ~256 ft to keep the cyclone sampler from plugging.

Preliminary evaluation shows that the sediments encountered during drilling were Hanford formation silty sandy gravel and sandy gravel from the surface to about 53 ft bgs and sand, gravelly sand and silty sand from 53 to 133 ft bgs. Sandy silt of the upper Plio-Pleistocene exists from 133 to 137 ft bgs and lower Plio-Pleistocene sand and silt and silty sandy gravel with caliche exists from 137 to 145 ft bgs. The Ringold Formation member of Wooded Island, unit E was encountered from 145 ft bgs to the bottom of the borehole. The geologist's log is in Appendix A.

Sediment samples were collected at approximately 5-ft intervals for geologic description and archive throughout the entire borehole. Two split spoon samples were collected from 224 to 226 ft and from 257 to 259 ft bgs for analysis of grain size distribution. Data are in Appendix B.

The borehole and drill cuttings were monitored regularly for organic vapors and radionuclide contaminants. No contamination was noted by field screening methods. The borehole was geophysically logged with spectral gamma-ray and neutron moisture tools on August 15 and 16, 2001. Cesium-137 was identified near the surface at 0.4 to 1.4 pCi/g. No other manmade radioisotopes were found. The geophysical logs are in Appendix C.

4.2 Well Completion

The permanent casing and screen were installed in well 299-W19-45 in August 2001. A 4-in.-inside-diameter, stainless steel, continuous wire wrap (20 slot) screen was set from 259.03 to 224.12 ft bgs. The permanent casing is 4-in.-inside-diameter stainless steel from 224.12 ft bgs to 2.11 ft above ground surface. A 2-ft-long sump from 261.13 to 259.03 ft is attached to the bottom of the screen.

The filter pack is 10 to 20 mesh silica sand from 266.1 to 213.4 ft bgs. The annular seal is bentonite pellets from 213.4 to 207.3 ft bgs, bentonite crumbles from 207.3 to 9.5 ft bgs, and Portland cement from 9.5 ft bgs to the surface. A 4 ft by 4 ft by 6 in. concrete pad was placed around the well at the surface. A 6-in. stainless steel protective casing with locking cap, four protective steel posts, and a brass marker stamped with the well number were set into the concrete. The Well Summary Sheet (as-built) and Well Construction Summary Report are included in Appendix A.

The vertical and horizontal coordinates of the well were surveyed in December 2001. The horizontal position of the well was determined by Global Positioning System observations referenced to horizontal control stations established by Rogers Surveying, Inc., Richland, Washington and the U.S. Army Corps of Engineers. The coordinates are Washington Coordinate System, South Zone, NAD83(91) datum. Vertical datum is NAVD 1988 and is based on existing benchmarks established by the U.S. Army Corps of Engineers. Survey data are included in Table 2 and the survey data sheet is included in Appendix A.

4.3 Well Development and Pump Installation

Well 299-W19-45 was developed in August 2001. A temporary, 1 hp, submersible pump was used to remove approximately about 3,940 gal of formation water. First, about 3,540 gal of water were removed at 30 gal/min with the pump intake at 257.5 ft bgs resulting in 17.3 ft of drawdown. Then about 400 gal of water were removed at 10 gal/min with the pump intake at 236.5 ft bgs; drawdown was about 4.4 ft. The final turbidity was 1.20 NTU.

A dedicated, Redi Flo-2 submersible sampling pump was installed in well 299-W19-45 in September 2001. The sampling pump intake is at 235.35 ft below the top of casing (8.5 ft below the water table). Static water level in the well was 226.85 ft below top of casing on September 4, 2001.

5.0 References

Ecology - Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy. 1998. *Hanford Federal Facility Agreement and Consent Order*. Document No. 89-10, Rev. 5 (The Tri-Party Agreement), Ecology, Olympia, Washington.

NAVD88. 1988. North American Vertical Datum of 1988.

RCRA - *Resource Conservation and Recovery Act.* 1976. Public Law 94-580, as amended, 90 Stat. 2795, 42 USC 6901 et seq.

Smith, R. M., F. N. Hodges, and B. A. Williams. 2001. *Groundwater Quality Assessment Plan for Single-Shell Tank Farm Waste Management Area U.* PNNL-13612, Pacific Northwest National Laboratory, Richland, Washington.

WAC 173-160, Washington Administrative Code. *Minimum Standards for Construction and Maintenance of Wells*. Olympia, Washington.

WAC 173-303, Washington Administrative Code. *Dangerous Waste Regulations*. Olympia, Washington.

Appendix A

Well Construction and Completion Documentation

WELL CONS	STRUCTION	1 6117	ANAAE	OV DEDODT	Start Date		13-0	
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A.1

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SS 304L	Portland coment Gout 0-11.6		-	7, 0 8 6 7.	1-19' Grav	relly Sand (GS) Ay Gravel (SG)
6+anulat Bentonite: 11.6' → 202.0' 11.6' →	SS 304L +1.91 + 218,27'		40	10,000 2	7'-30' S: 1t	y Sand (ms)
11.6' → 202.0' Bentonite Pellets: 202.0' → 207.8' Bentonite Pellets: 120 — 1326 Sandy SILT (SIM) (R1' SITE layer) 120 — 1326 Sandy SILT (SIM) (R1' SITE layer) 120 — 1326 Sandy SILT (SIM) (R1' SITE layer) 120 — 1326 Sandy SILT (SIM) (R1' SITE layer) 120 — 1326 Sandy SILT (SIM) (R1' SITE layer) 120 — 1326 Sandy SILT (SIM) (R1' SITE layer) 120 — 1326 Sandy SILT (SIM) (R1' SITE layer) 120 — 1326 Sandy SILT (SIM) (R1' SITE layer) 120 — 1326 Sandy SILT (SIM) (R1' SITE layer) 120 — 1326 Sandy SILT (SIM) (R1' SITE layer) 120 — 1326 Sandy SILT (SIM) (R1' SITE layer) 120 — 1326 Sandy SILT (SIM) (R1' SITE layer) 120 — 1326 Sandy SILT (SIM) (R1' SITE layer) 120 — 1326 Sandy SILT (SIM) (R1' SITE layer) 120 — 1326 Sandy SILT (SIM) (R1' SITE layer) 120 — 1326 Sandy SILT (SIM) (R1' SITE layer) 120 — 1326 Sandy SILT (SIM) 120 — 1326 Sandy Silty Sandy GRAVEIL 120 — 1326 Sandy GRAVE			-	- 050 ° -	7-52 5:17	ry sandy GRAVELL
Bentonite Pellets: 202.0'→207.8'			80 -	- - -	<u>6'- 69.5'si</u> ,9.5'-119' 51	ity sandy brnvéilm Ano (s)
Wellscreen: SS 304L 0.020-in slot cont. wire- wrap				- -		
Wellscreen: SS 304L 0.020-in slot cont. wire- wrap	Bentonite Pellets: 202.0'→ 207.8'		120 -			•
Wellscreen: 55 304L 0.020 in slot cont. wire- what				- 5,50	136 - 144 - 2	ity sandy Gravel (no
Wellscreen: SS 304L 0.020 in slot cont. wire-			140 -	-0000 -0000 -0000	180 – 220.5	(n 1) 1 ty sandy GRAVÉ
ω_{MA}						
Wrap 218.27' → 253.28' 218.27' → 253.28' 218.27' → 253.28'			× 000			
- cooper sandy gravel	wrap 218.27′→ 253.28					

VAICE	CHAMADY OF	ICCT		•	Page 2 of 2	
WELI Well ID: C 3395	SUMMARY SH	Mell Name: วจจ-เล-40				

Location: Sw Corner of 241-4		Reviewed I		RA Orilling	Date: 10/10/a	
Prepared By martines LD Walker			787 / C	Weekes	Date: 10/10/01	
Signature: cmartine, Muches CONSTRUCTION DATA		Signature.	<i>, , , , , , , , , , , , , , , , , , , </i>	GEOLOGIC/HYDRO	I OGIC DATA	
		Depth in	Graphic			
Description	Diagram	Feet	Log	Lithologi	c Description	
Sandpack:		240-	1000		-	
10-20 mesh silica		_	\$25.0	250.0 - 2525	cemented silty	
207.8'→ 257.8'			00.00	sandy q	rave)	
] <u> </u>		2525 - 260 si	Ity sandy gravel (MSC)	
Tailpipe with welded		-				
endcap: 253.28 -> 255.28'		280 -		TD = 260	6 9/27/01	
		-		WL = 214.	6' 9/27/01	
WHAT'S FROM 257.8 TO 26	*	-			·	
SLOVGH? ES		-				
		-	-			
		300 -				
All temporary casing		-	-			
removed from ground		-	-			
		-	-{			
All depths are in Feet		-	-			
below ground surface		_	-			
		-	-			
		-	-			
	_	-	_			
	4	.	_			
	_	-				
	_[[[],[],[],[],[],[],[],[],[],[],[],[],[]	.	-{			
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			_			
		-	_			
			-1			
		1	_			
	_	;	_			

ERC Project:				ATA RE	~ ~141	
	22192	·	I	repared		. Wagner, P.L.S. rveying, Inc.
Date Requeste	ed: 11/19	/01	F	Requesto	r:	
Date of Surve	y: 12/05/	01		Surveyor	Rogers Sur	veying, Inc.
ERC Point of	Contact:	Mr. Robert Bone			o. Point of Co	
Description of	f Work:				al Datum: N	
Civil survevin	g for eleve	n groundwater we	ells	Vertical I	Datum: NAV	D88
in 200W & 20			<u> </u>	Units: M	letric .	
			Ī	Hanford .	Area Designa	ation: 200W
Coordinate Sy	ystem: Wa	ashington State Pl	lane Co	ordinates	(South Zone))
Horizontal Co HSWB-037 & Vertical Cont	GPS31					
2W-43 & HSV		nents.				
Well Name	Well ID	Easting	Nort	hing	Elevation	
299-W18-40	C3395	566723.29	134996.41			Center of Casing
				, ·	203.413	"X" on Rim
		566723.28	134	1996.72	202.735	Brass Cap
Notes:				<u> </u>		
<u> </u>						
Surveyor Sta				Certifica	tion Seal	
		ssional land surve) ashington (Registr				
. Sister ca in in	•		ı			
No 304401 hos	~~ ~ ~~ +1/Y	arms arms rupor a to t				
No. 30440), her on a field surve		d in December, 200	01			

BHI-EE-202 (09/98)

			ВС	REHOLE LOG		Page 1 of Q Date: 08(13161
Vell ID:	C-3395	í	Well N	ame: 299-1018-40	Location: 5 w corner	of 241-4
roject:	C 401	RCRA	111:00	nq	Reference Measuring Point	Ground Surface
	San	nple		Sample Des	cription	Comments:
Depth (Ft.)	Type No.	Blows Recovery	Graphic Log	Group Name, Grain Size Distribut Moisture Content, Sorting, Angula Size, Reaction	arity, Mineralogy, Max Particle	
o —	DIB	NIA	000	0'-10' Fill material	, 5; 1ty Sand . 15 %	Cable Tool. Drive Barrel
_	.	.	1000	5:12, 85 10 sand 100%	•	7/8"17" starting at
_	1 1		1080	10 YR 512 (grayish brow		7: 0-7'ved
_	.]	1000	· ` `	4	10"DB.
-			10 81			
5 -	- Archive	1	0,0			Grab Archive@ 5:0'
_]	0000	·		a, B, Y O Background
_	1 1		000			W. D. O BOCKETORIO
_	_		000			
		1 1	SUS.)	·	
- درا	- - -]	000			
' -	- Anchive	4	్రి : <u>ర</u> ె	10.0'- 17.0' 511ty San		
-	_	1 1	000	gravel, 15°10 sand, 10°1		
	-	1 1	20	poorly sorted 500 vf-f		
-	-)	1 1	000	Gravel 80 % Sm, 10 % m	•	1
	- ↓		503	Febics, 40% basalt. 104	R 6/2 light brownish gray	
15 -	- Acepius	-	$\mathcal{D}_{\mathcal{D}}^{\mathcal{D}}\mathcal{D}$	Strong rxn HCI.		Grab Ambive @ 15.0'
	-		20.5); 6		of, B. & B background.
1	-\ \		20.00	17.0'- 19.0' Gravelly S	and. Sand 75° to Gravel:	3
1	-	1	Ø	5 and vf-m, 5A, mod 50		
	-1 .1		25	80-85° to med, Gravel 8		
20 -	- Rosiva	-	0.00	mad sorted SR-SA, 75	•	ed
	_ \	7	20	1 N	,	
	_\ \	1 1	<i>ؼ؋ٛڟ</i> ۣ؋	0 104R 4/1 (dark gray), 10	(36) Sand 35% Grave	1 6 mb Ambius @ 20.0'
	_	-	93°C		dagaridian Gana	K. B. R. Background
	_		0.00	65 10. 50me as above	description, Graves	
	1.1	⅃ ℹ	<u>0,</u> ≤	⊃ ∮ ` • •	ebbles, 2010 v ese-coe,	cobble max size 135 m
36	gastne	~	0.8.8	20 10 sm pebbles.		
	_		<u> </u>	2:3.0 - 51:6pal	y silty samly gravel & 1	
	-			5 17 25 10 sand, 70 10	gravel. Sand f-ucse	d. B. to hackground
	-			5 15 Vf. 35 10 med, 4	0 10 cse - V cse . 100 10	
_	لايات	<u>, V</u>	[<i>注</i>]	10 25 40 10 ptz. Procly 300	ted (sand grave) SA-SR	
		harlen	Marti		iewed By: 1) Cukeke	52
Title:	Geole	og:st		Title	: 600/0915t	
Signa	ature: 🕓	arlan	Martin	Date: oglisto) Sign	nature: Makethed	2 Date: /0/10/0/

			ВС	REHOLE LOG		Page <u>a</u> of <u>9</u>
Well ID:	3205		Well N	ame: 299- w18-40	Location: sw corner of	
		era ori			Reference Measuring Point:	
,		nple		Sample Desc		Comments:
Depth (Ft.)	Type No.	Blows Recovery	Graphic Log	Group Name, Grain Size Distributi Moisture Content, Sorting, Angula Size, Reactio	on, Soil Classification, Color, rity, Mineralogy, Max Particle	Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
30	Archive	n/A		230 (cont from fg1) 6 row. 30 10 med, 10 10 cose. Tr 5/222 70 mm. 104R5121 30 21-30 silty sand (5 and vf-f, well sarted hosalt. 104R513 (brown)	ace sm problem max (arguish brown) strong ran Ho ms) 10 /0 Silt 90 /0 . 80 /0 ate (other) 10 /o) Strong ran HCI	35: Archive
40-	Archive			30.0'- 47' Sand (5) v 30°10 med, 100'10 cse-vcsi basalt, 35°10 gtz(other) i Basalt content decr 80% gtz/feld, 10YR5 At 38' thin, moist clastic dike	c. 54, poorly sorted, 65°C OYR 511 No rxn HCl. case: af 35', ~20% base	H 40': Archive sample
45 -	- Archiv				Sand, 15% Silt. 10% v.cse-cse, 30% med Sand predom fn-v.fn. ray), dry; poorly sor SA; Gravel 70% gtzite ; Sand 70% gtz/feld	teel
55	-	hive		max cobble size of gravel content of 53' -> 56' : Gravel 570 Stavel, 80% S predom med-fn pe 104R5/2 (gryish broken strong 5	LID cm Lecreuse Accreuse Avelly SAND (95 and, 5% Silt Grave b. Sand v.cse-cs	e VEL
		Charles	ne Me	Title Title	- / - /	<u> </u>
	e: <i>Geolo.</i> nature: <i>C</i>	gist Darlon	· Most	13-1/2/1	inature: Malecha	Date: 10/10/01

			В	OREHOLE LOG		Page <u>3</u> of <u>9</u> Date: 8/22/6/
Well ID:		3395	Well N	lame: 299-W18-40	Location: SW corner 2	
Project:		01		Drilling To	Reference Measuring Point:	
		mple	1001111	Sample Des		Comments:
Depth (Ft.)	Type No.	Blows Recovery	Graphic Log	Group Name, Grain Size Distribu Moisture Content, Sorting, Angula Size, Reacti	arity, Mineralogy, Max Particle	Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
60-	DIB Archive	grab NA	0.00	from 54- 69.5 Sile		grabsample @ 50'
_				of 10% silt, 35% sand and		
_			8000	25% f, 40% m and 35%c	r in SA-SR grains Gra	net
-			0000	is 20% f, 30% m and 50		
-			0.00	(max size is 6"x3/2"	x 2/2" - la cobble to so	xl's of clear, red -
65-	Archive	grab	230	boulder) Unit is poor		
-	1		5.20	no rxn & HC1. BY 62	unit contains 15-17%	
-			70.00	Silt - this does not look li	he Hanfordfm. as it	HCI.
-				cortains MnOx's, MnCOz's, CaC	03, CaSO4(3), w/contorted	RCT: < dedect
-				sitlenses and SA-A f-n	n gravel	IH: < detect oum, LEL)
70 —	1 ochive	grab -		Igrock @ 66.5', then	pebble, cobble sm. boul	dec
-				gravel W/65% Basalt.:		
-				69.5-119' Sand	(5) 95% sand,	IHTech: < detect 154
-				5% silt, mod well son	ted wy 75% vf-f, 25%	
-				m. grains that are SR-R.	the unit is It brown in	
75 —	Archiva	grab		color and dry 10/ mod-sq .	run to HCI by 29 the	
-		[]		median grain size is mediui	n	
80—	Anhwe			Sut content continue	es fo increase	
_	ARTHUE	grab		@ 81' - thin site lov	ers w/ laminar app	ront
_				bedding. the unit		
_	.			sandy silt and silty.		
_	.	-			mittent silt lenses	
85-	<u> </u>	1 ,		the unit does not rea		
_	Archive	19res				
_	_	1				
_						
_						
Reporte	d Ву: <i>Л</i>	Faur	ote	Review	wed By: DCUkekes	
Title:	ellogi	st		Title:	Geologist 1	
	e:////			Date: \$\mu_{n2\sqrt{0}}\$ Signat	10/2///	Date: /0/10/01

			ВС	REHOLE LOG		Page <u>4</u> of <u>9</u> Date: 8/22/01
Well ID:	C 33	95	Well N	ame: 299-W18-40	Location: Woor 241-UTa	
Project:	CYOII	ecra Da	illing		Reference Measuring Points	
		nple		Sample Do	escription	Comments:
Depth (Ft.)	Type No.	Blows Recovery	Graphic Log	Moisture Content, Sorting, Angu	oution, Soil Classification, Color, ularity, Mineralogy, Max Particle ction to HCl	Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
90-	DIB	grab NA		SAND - sim	ilar to above	Cable tool, drive
	ا	13,43				barrel; Casing
_		<u> </u>				10 34"00/9 12" ID
-	.) }			93': silty sand		
-	-					
95-	- Archive	grab		SAND(S);	95-100% Sand, tr-	95': Grab sample
-	-			5% Silt. 10	70 med, 60% fn, 30%	for archive
-	-			V. Fn. 10YR 6/3	(pale brown), sl moist	
-	-			well sorted, SA-5	80-90% 9tz/Feld	
-	-].	1 1		10-2090 basalt/o-	ther, no rxn HCI	
100-	- Archive	grab				100': Grab sample
-	-			100': Sand slightly	coarser- predum	for archive
	-			Fn-mcd, d	<u>ry</u>	ļ
.	-					
	-					,
105-	- Archive	grab			to above, but	105 : Grab sample
1	-			predom i	neof	for archive
ŀ	-			<u> </u>		
	-			<u> </u>		
	-					
110-	-			3 SAND (S) 10	00% Sand, tr silt.	111': Grab sample
	- Archive	_ grab		10% cse, 50%	, med, 40% fn-v.fn	for archive
	-			104R5/2 (grayish	brown), s/ moist; mod	-
	-			well sorted, s	A-SR; 75% gfz/Feld,	
	-	ļ		2590 basalt/other	mafic, tr mico, no	
115	Archiv	<u>c</u> grub		TXN HCI		115': Grab sample
	-	1		1151: Silty	SAND	for archive
	-					
	-		1, 183			
	<u>- </u>		Y 接線		ease	
Repo	rted By:		. Wa Ike	•	eviewed By: DC Weeke	<u>.</u>
Title:	6	TO A	·s+	TI	tle: Geologist ignature: M. Tyleelkel-	
Sign	ature:	TA) 1	relk	Date: 8/23/01 Si	ignature: // Lybelhet	- Date: /0/10/01

			В	DRE	HOLE LOG			Page <u>5</u> of <u>9</u> Date: <u>8/23/01</u>
Well ID:	C:	3395	Well N	ame:	299-W18-4	0	Location: SW Corner 2	41-4 tank Farm / 200W
Project:		01 RC	RA Ori	llina			Reference Measuring Point:	
		mple	NA CAPE	11.43	Samp	e Desc		Comments:
Depth (Ft.)	Type No.	Blows Recovery	Graphic Log		e Content, Sorting,		on, Soil Classification, Color, ity, Mineralogy, Max Particle n to HCl	Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
120-	Archive	grab NA		119	-> 132.5 S	andy	SILT (SM)	Cable toul, drive barrel
	Cable					,	It. Sand is Fn-V.Fn.	Casing: 1034" 00/9/2" I
-	1 1 1			2, 4	Y 5/3 (It. oli	re bro	wn) sl moist, well	
_	is one		-0.77				80-90% gtz/feld,	120': Grab sample
-	0			10	9-20 % other;	strar	ng rxn HCI	for archive
125-	Archive	grab					io-Pleistocene (early Pal	œse)
_				12.	2': 20% sand,	80%	Silt, str rxn HCI	Difficult drilling:
-								Driller says "That's one
_	}		7.E.E.					tight hole"
-]]						125': Grab sample
130-	Archive	grab		5;	It with v.f.	Sand	, as above	for archive
<u> </u>								130': Grab sample
-	Archive	1006					andy GRAVEL (msG)	
-] 3,40	四面	1			% Gravel, 35% Sand, 30%	
-				1		-	prodom ese-med peb	132.5': Caliche - grab
135-	Acchive	gmb	600				, 40% med - v. fn.	sample for archive
-			Y SO	1	•		brown) sl moist,	
-			200		,		Gravel 40% basalt,	135: Grab sample
-			099	1	•		nax size > 10 cm,	For archive
-				u u			1 - fragments of	
140 -	Archive	grab.	000	ma	ssive caliche		,	140': Grab sample
-	1	1 1	Og]	-decrease it	cal	iche, gravel increase	for archive
-	1		0000				ilty Sandy GRAVEL	
-	1		88				, 25% sand, 15% Silt	
-	-		88	de			but still coating	145 : Grab Sample
145-	- Archive	grah		on	some grave	. Gra	vel R, predom cse peb	for archive
-	-		983	to	sm cobble	Dry.	1 (1 / 1	
-	- ,			₹——	14' -> 180'		indy GRAVEL (SG)	1 1
_	Hand	Air Rota		70			znd, 5% silt.	148': Begin harden
Potest	1 100				caliche -		ak rxn HCl	Air Rotary drilling
Reporte			<u>va Ike</u>	<u> </u>		Review	D	
Title:		ologis	1 00	,			Geologist re: /XC/Ilbohar	Date: /0/10/01
Signatu	10.	w a	alle		Date: 8-28-01	Jignatu	is of appeared	Date: /0//0/0 f

		-14	В	ORE	HOL	BOREHOLE LOG Page 6 of 9 Date: 8/28/01									
Well ID:		3395			·				Loc	cation: SW corn	a b 20		/ 1/ /		
Project:	<u>`</u>	01					- 44 7 6			ference Measuring				-	
,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Sai	mple	VCK	<u>η υ</u>	rillin	9_	Samn	le Desc	_		J 1 O.11.	- 1000	omme	Surface	
Depth			Graphia				······································		<u></u>					ng, Drilling	
(Ft.)	Type No.	Blows Recovery	Graphic Log	Group Moistu	Name, ure Cont	Grain ent, S	orting,	istributio Angulari Reaction	ity, i	Soil Classification, Mineralogy, Max P HCI	Color, article	Method, Sampli	Methong Too	od of Driving ol, Sampler or Level	
150-	Antive	0119	200							ravel, 5% si		Air Rot	ary.	tricone bit	
-			005	20°∕9	Sand.	G7	cavel	30 /	0 1	25alt, 20%		Grab	Acehi	<u> ଜରାଚ୍ଚ୍ୟ</u>	
_				atz (other)	۰۵ک	3d , 50	<u> </u>	, pc	enly sorted.		≥.٥.≤	, ০র	130101	
-			85.0	430%	baso	74	30°10	952 (c	7 †}	er) 7.5 YR 6	11				
-			300°	(gra	W. no	, r)	th_a	ci. 5	or AA	1, 15% fn					
155-	Archive]]		ر°و ی	o med	<u>, </u>	25%	csel	س	ess.		6 rab A	rehio	e @ 155'	
_												a, B, x	$c \angle a$	otest.	
-			10000									RCT CA	Cm.		
-															
-			5000	ļ	 .										
160-	A rchive		0.00									Grab A	cchive	@160	
-	.		3.20												
_			80.0											\	
_	.		500												
-			20												
165-	Archive]	100									Grab A	Irchi	ر کما رها	
-	.		1 0 D									ļ.		< derect.	
_	.											ZH (
_	.		Soc												
			20					• ,				(8.M.)	× 28	か	
170-	A crive	-	503		•	,,,,,,,,						1,	Karo		
		1	000			•···								мD 170'	
_			15 B A	i				····				(5 1 dts: 1	W.O.B.	700 (10	
_			200							······································		Horrd	T001.	(a) 175'+	
			020			411		-				(AM)d,			
,		4	080		<i></i>					•					
175	Bresive HIT	1	-0	175	Santy	P wh	<u>ul. S</u>	ame c	3. 5.	above.		1		ve Q 175	
-			0.20	-										131101	
-	و الح		27	<u>:</u>								l .		\LEL	
-	Cable		2007	<u> </u>										. Pm	
Possate	<u> </u>			il			1	Davida		7/1/	. [1 ppm	(IH)	
Title	и ву. <i>С</i> у	Jarlene	Mart	inez,	/105WA	TSON		Reviewe		Dewe	tes				
Signatur	<u>, 60/08/1</u>	5 <i>T / SCIE</i>	16114		Data	- اه		Signatur		eologist	les o		Date:	alialai	
Cignatul	· Cho	regre V	North	٠	Date: c	<u> </u>	0101	oignatur	· C.	Jacaria de la constante de la	CON.	·	7016.7	71401	

			50	DELLC	N. F. I. O				Page <u>7</u>	
			BC	REH	DLE LO	G			Date: oq1	04101
Well ID:ر	.3395	···	Well Na	me:>qq-	-w14 -40			i.w. corner of		
Project:	C401	RCRA	on: Win	3	:		Reference	Measuring Point	Ground S	urface
	Sar	nple	l	`	Sa	mple Desc	ription		Co	mments:
Depth (Ft.)	Type No.	Blows Recovery	Graphic Log	Moisture C	Content, Sorti Si	ng, Angulai ze, Reactio	ity, Mineral n to HCI	ssification, Color, ogy, Max Particle	Method, N Sampling	Casing, Drilling Method of Driving g Tool, Sampler Water Level
180-	ARCHIEVE	nia	100	180'-3	5120.5 61674 SAND	GRA	VEL (no	5(5)-50%	(a.m.) 4	(em) RUT
_	HIT	<u>[</u> .	000		-			PAVEL 15	x. 3. x	(background
_	_	<u> </u>	500			•	-	UB-ROWNED,	GRAB ARC	HIVE @ 180'
_	_	1 1	<i>影鳴</i>					CS, 50% MS,		oglorio
.	_		200					, NORXN +KL		
185 -	- annive	-	820	(olop:	7,5 YR	6/, (GRAY	J			rehive DIS51
.	- 1]	3.0°5						20=2	LALM (AM)
	_		50	186	siltu sandu	aravel.	ms6).10	0% gravel,	1	B Dackgroun
	_\ \	\	000					Sorted, S.RSA.	(A.m.)	
1.	_	1 1						vese-ese;		
190 -	- Archive	4		**1				-felsic rich.	Grab A	runive@190
	_ 1	7	805					ight brownist		umler, co
1	_	}		<i>:</i> .1	(dry same					ಚೀವೆ
	_			4 4	-				9, 2, 8	10 background
			[35]	§					1	09/10/01
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	_ 1		27				·-		Grab	Archive@195'
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			70 3	2						
		_	2.	4					Grab An	کرناید کی محصر
700		-	2	8						drilling.
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200	Hnen!	العوا	0 Q	\times						Archive @ 205
	_	1 1	Ø.					A.M. Ck		Obackground
		-	10		-			44.7		LÉ L, organics
	-									etect.
Bor	orted By	· •	1;8,40	WALL		Rev	riewed By:	DCWeek		
			ene w	Jarti ne	۲	Title		ologist.		w
	3: Geob		<u> </u>	<u> </u>	Date			Vita lan		Date:/0/10/6/
Sig	nature:	saren	e mart	<u>uq</u>	Dare: 04/	oylo, Sig	nature.	acheren		171901

		Page 8 of 9 Date: 091 Ulot						
Well ID:	C3395		Well Na	ame: 299	7-w 18 -40		Location: 5 w. cormer	
Project:		RCRA Q					Reference Measuring Poin	•
	Sample Sa				Sample	Desc	ription	Comments:
Depth (Ft.)	Type No.	Blows Recovery	Graphic Log	Group Na Moisture	ame, Grain Size Dist Content, Sorting, Ar Size, Re	ngular	on, Soil Classification, Color rity, Mineralogy, Max Particle n to HCl	Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
סוב	Archive.	n14 	02.0	210 5:1	Ity Sandy Gra	vel.	Same as 185'	Grab Archive Q ZW
-		ļ. ļ	0.0	desc	cription			Pm ck => d & B0
-			Ω					background.
-				212 0	cobble stuck	en.	drill bit. > 110'mm.	oum LEL & detect.
-			0.0	visible	e Fe staining	<u>ą. s</u> c	andy silt coating.	8.0.5, 212 09(12/01
216 	Anhive	1	50.0				(dry): sand, SA.	Grah 215 Archive
-	1		P6 0	mod sor	ried 60°10 base	it,	40°10 felsics. 75°10	oumless, co <
-	-		592	7	25 10 050- 0	دة و	. Sand 10 YR 5/3(bran	m) Actest. (A.M. CE)
-	-		R 50	dry sa	imple no rxn!	<u>461</u>		
-								
220-	- Archiva	डरे। द					3 silty sandy Gravel	Grab Archive @ 220'
-	-	50001 100%	1 1 1	S S	'		t, 15% sand, Trace	E.o. S. 09/13/01
-	-	16 C.					orly somed max siz	
-	-	NIA	12000	и	•		pebbles, 10 10 5m	Still hand drilling
-		_	20.00	:J.			es, 45°10 sm cobbles.	
225 -	-Archive	-	\$ Q.3	S I			ted, 50°10 vf-f,	Grab Archive @ 225'
'	-	1	19 17 1 000	7.1			~~	or, B. 8 @ background
1	-			J4 .	- 1		erved: 10 YRulz, gray	·
	-		200	104R	513, brown;	10 Y R	2812 very pake brow	n,
	- \		001	<u></u> 1	•		13 y 25 x nword dei	
230-	- Archive	-	00 S	Pale .	4411000; 5 Y 5	<u>la</u>	Olive gray; 54R 3	2 Frab Archive DZ30
l	-	1 1	35	dack	reddish brown	; _ 2	1.5 YR 411 white;	
1.	-			Gley	1 7/1 (10y) 1;c	ht q	queenish gray. No runt	101
	-			<u> </u>	***************************************			
	-			2225	- 250.0 S:14	<u> کی۔</u>	andy Gravel (ms6)	
235	- achire	=		9.4 _ .			25 % silt. Sand SR	SA, 6 rab Archive @ 235
	- 1			mak 30	orted, 60% bas	alt,	40 10 atz (other) 60 1	
	-		類似	g 4-£	20°10 med.	20°6	CSE S' IT - felsic Me	h,
	-	\ \ \					ish gray) no rxn HCl	•
	<u>-</u> ψ	$\perp \downarrow $	· 译为	3			V 1	
Repo	rted By: c	harlen	mart	inez		Revie	ewed By: DCWeeke	5
Title:		logist				Title:	Geologist,	
Signa		٧.	Marti	مبر	Date: 09!12 01	Signa	ature: XX beke	L Date:/0/10/01

			ВО	REHOLE LOG		Page <u>9</u> of <u>9</u> Date: 09114101
Well ID:	C 3 3 9	15	Well Na	me: 299- w 18-40	Location: 5 . w . c see se	of JULY Tank Farm
Project:	C 4 01		Dr: (ling		Reference Measuring Points	
	San			Sample Desc		Comments:
Depth (Ft.)	Type No.	Blows Recovery	Graphic Log	Group Name, Grain Size Distributi Moisture Content, Sorting, Angular Size, Reactio	on, Soil Classification, Color, rity, Mineralogy, Max Particle	Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
240 <u>—</u>	H IT Archive	ala		240-5; Hy SON GRAVEL (M	106)- Jame as 227.5	Grab Archive@ 240°
-			2,5			Hard drilling.
_			が光学	· · · · · · · · · · · · · · · · · · ·		very tight formation
_			555			A.m. d. 2. No bockground
245 —	Aranive					Grab Archive@ 245'
-			10.79			P.M. Or B. Mabackground
-			2 2 2			P.M. Dumile Horganics
_			900			< detect
250	A rehive	SPLIT		250.6-252.6 cemented s		Enab Archive@ 250'
-	-	50%	10727	40% gravel, 20% sand,	20 % sitt. Gravel	of B & @ background (m)
-	-	recovery	-18 15:1- 0 :- : 1-:	poorly sorted SR-A, max	5:2e 70 mm, 5m peb 50	no Am I'm check
-	-	n la	0105	med peb 25%, coe peb 1	0 10, cobbles 15 10.	
-	-		900	70 %0 gcz (other) 30% bo	salt. Sand, SA, mad	
255-	- Archive	1	0 b	sorted vfn-vese 10°/0	vf-fn, 45 10 med,	Grabachive @ 255
-	-\	1	8.95	45 % cse-vese. 50 10 b	asato, 50% otr (other)	K. B. 80 background (P.M.)
-	-	1 1	00	silt-felsic rich. Trace	clay = non-plastic.	ormiLEL Edet.
-	-	1 1	8 9 %	~ 5 10 iron oxide conter	γ ,	
.	-		0.4	10 YR 6/2 (main) light brow	inish gray: 104R713	
260 -	- Archive	<u> </u>	TO (Vet)	very pale brown; 5 YR 8/1,	, -,	Grab Archive 260
	-	1		light reddish brown; 2.5 Y 5	•	
	_		1	25 4 7/2 light gray; 2	, ,	
	- _			2.54 8/3 pale vellow; Gie		
	-)		greenish gray. no rxn b	•	
265-	- 7	\exists_{a}	Ì			
	- /	New		252.5- 210.0 511ty Sand	14 Gravel (ms6) 60%	TO=260' bgs
	-14	-		Gravel, 25 % sit, 15 %		
	-	-		mod sorted, 50 10 basalt,	1 97-4	
	<u>- \\</u>	_		30 % med, 25% vf-fn. 1	OYRUIZ light brownish	no ran HCI.
Repor	ted By: 🤈	narlene	norn	ez Revie	ewed By: DC Weeke	
	Geologi			Title:	Geologist,	
Signa	ture:	arone	marting	Date: oq\\\$\o\	44/4 7.1	Date: 10/10/01

		· · · · · · ·		S	tart Date: 9-5	-01	ĭ
WELL CONST	FRUCTION	SUM	MAR	Y REPORT	inish Date: 9 - 13		
		37815		MARCARD	Page _i		
edification No.: 0200X-5P - R	au Na i	2 10.5			emp. Well No.: c		
Ns: NA	.ev. No.: 3			Approximate Location: East Si			
ject Ctol RCRA D				Other Companies: C 4 =	<u>de of 241-</u>	ч	
lling Company: 9	rilling			Contraintal Charles Martinez	, Les Walker, M	like Faural	le.
lling Company: Resonant			—— `	Catherine Trice, Jes	s Hocking, John	· Wimett	-,
الer: ٢٠٠٤ عن 150م # /2 TEMPORARY CASII		TÚ Z Z	STEEL S	DRILLING METHO	DAOLE DIAMETE	D .046 4 4	2 E.V
*Size/Grade/Lbs. Per Ft.	Interval	Shoe O.		Self-Wall Self-W	Diameter From	to	2000000
hreaded Carbon Steel 12".		113/44/10		- 11 - 11	Diameter From 12		-
(57)	+Z.00 - Z7Z.0'	8341/8			Diameter From	5 , c	<u> </u>
ireaded Carbon Steel 8		87 / 8			Diameter From	to	
·	 -						
					Diameter From	to _	7 - 7
diest Molded (MA) Flush I-1-				CA21 C 1001 C - (2	Diameter From		172
dicate Welded (W) - Flush Join	t (FJ) Coupled (C) a	L Inread (Design		Diameter From	to _	
					·····		
	-			Drilling Fluid: WATER			
		a "		Total Amt. Of Water Added During	Drilling: טא אווסע	N .	,
ell Straightness Test Results:	PASSED using	3 20.4			Date: elsfol	9/5/	01
D Straightness tool. C	9105101	∲ GEO	PHYSICA	L LOGGING			in the
Sondes (type)	Interval	Da	te	Sondes (type)	Interval	Date	e
spectral Gamma	0'-245'	9/4/	61				
pectral Gamma	<u>o'</u> - <u>245'</u> 244' - 270'	9/4/	61				
pectral Gamma		9/4/ 9/5/ 9/5	101				
	244'-270'	9/5/	101	ED WELL			
pectral Gamma	244'-270'	9/5/	101	ED WELL	Interval Annual Seal/Filter Pack	Volume	
Size/Wt./Material	244' - 270' 60' - 230.86' Depth	9/5/ 9/5/ Thread	O/ O/ OMPLET	Colored Type 50# bags	Annual Seal/Filter Paci	11	Mesh Size
Dectral Gamma Veutron Moisture SizeWt.Material 4"ID \$\$ 304L Riser	244′ - 270′ 60′ - 230.86′ Depth	9/5/ 9/5/ Thread F440 nthe	O/ O/ OMPLET Slot Size	Colored Type 50# bags	Annual Seal/Filter Paci	38 295	Size
SizeWt./Material 4"ID SS 304L Riser	244' - 270' 60' - 230.86' Depth +Z.00 - 229.9 229.9 - 264.9	9/5/ 9/5/ Thread F 480 CHRE F 480	O/ O/ OMPLET Slot Size	Colorado SO# bags Colorado Silica SAND BENTONITE PELLETS D# bags	Annual Seal/Filter Paci 272.0 - 218.9 218.9 - 213.03	38 5046 116 . 660 -1 Duck	Size
SizeMt./Material 4"ID SS 304L Riser	244′ - 270′ 60′ - 230.86′ Depth	9/5/ 9/5/ Thread \$4400 \$1198 \$430 \$119	O/ O/ OMPLET Slot Size	Type Colorado 50# bags Colorado Silica SAND BENTONITE PELLETS BENTONITE CRUMBIES BENTONITE CRUMBIES	Annual Seal/Filter Paci 272.0 - 218.9 218.9 - 213.03 213.03 - 10.3	38 0000 116.000 116.000 130.75 b	Size 10-20
Dectral Gamma Neutron Moisture SizeMi./Material 4"ID \$5 304L Riser \$-020" Cont. 4" \$5 804L Wire Wrap Screen	244' - 270' 60' - 230.86' Depth +Z.00 - 229.9 229.9 - 264.9	9/5/ 9/5/ Thread F 480 CHRE F 480	O/ O/ OMPLET Slot Size	Colorado SO# bags Colorado Silica SAND BENTONITE PELLETS D# bags	Annual Seal/Filter Paci 272.0 - 218.9 218.9 - 213.03	38 0000 110 0000 1 Duck 131,75 b 267,45	Size 10-20
Size/Wt./Material 4"ID SS 304L Riser 6"55 BOYL WITH WAY SWEET 4" SS 304L Sump	Depth +Z.∞ - Z29.9 229.9 229.9 229.9 229.9 264.9 - Z66.9	9/5/ 9/5/ Thread F.480 F.480 F.480	O/O/O/O/OMPLET Slot Size	Colorado SO# bags Colorado Silica SAND BENTONITE PELLETS BENTONITE CRUMBLES PORTLAND CEMENT	Annual Seal/Filter Paci 272.0 - 218.9 218.9 - 213.03 213.03 - 10.3 10.3 - 0	38 03 80 10 mol 1-1-12 (5) 1-31-7-3 b 20-7-45 1-31-7-3 b 20-7-4-5 b 20-7-4 b	Size 10-20 10-20 10-30 1
Dectral Gamma Neutron Moisture SizeMi.Material H"ID SS 304L Riser 1" SS 304L Riser H" SS 304L Sump	Depth +Z.∞ - Z29.9 229.9 229.9 229.9 229.9 264.9 - Z66.9	9/5/ 9/5/ 9/5/ Thread F480 F480 F480	O/O/O/O/O/O/O/O/O/O/O/O/O/O/O/O/O/O/O/	CTIVITIES	Annual Sea/Filter Paci 272.0 - 216.9 218.9 - 213.03 213.03 - 10.3 10.3 - 0	38 593	Size 10-20 10-20 10-30 1
SizeMi./Material H"ID SS 304L Riser 1" SS 304L Wire Wrap Screen 4" SS 304L Symp Quifer Test: (Nell Devel	Depth + 2.00 - 230.86 ' Depth + 2.00 - 229.9 - 204.9 - 204.9 - 206.9 - 206.9	9/5/ 9/5/ Thread \$450 \$156 \$430 \$156 \$156 \$156 \$156 \$156 \$156 \$156 \$156	O/O/O/O/OMPLET Slot Size	Colorado SO# bags Colorado Silica SAND BENTONITE PELLETS BENTONITE CRUMBLES PORTLAND CEMENT	Annual Seal/Filter Paci 272.0 - 218.9 218.9 - 213.03 213.03 - 10.3 10.3 - 0	38 03 80 10 mol 1-1-12 (5) 1-31-7-3 b 20-7-45 1-31-7-3 b 20-7-4-5 b 20-7-4 b	Size 10-20 10-20 10-20 10-20
SizeMi./Material 4"ID SS 304L Riser 4"SS BOOL WARD SCARL 4" SS BOOL WARD SCARL 4" SS 304L SUMP Aquifer Test: (Nell Devel Description: Used Submer	244 - 270' 60'-230.86' Depth +2.00 - 229.9 229.9 - 200.9 201.9 - 200.9 opmen sible pump to	9/5/ 9/5/ Thread F480 F480 F430 THE F430 P430 P430 P430 P430 P430 P430 P430 P	O/O/O/O/O/OMPLET Slot Size	CTIVITIES	Annual Sea/Filter Paci 272.0 - 216.9 218.9 - 213.03 213.03 - 10.3 10.3 - 0	38 593	Size 10-20 10-20 10-30 1
SizeMt./Material 4"ID SS 304L Riser 4"SS 304L Wing Wing Screen 4"SS 304L Sump Aquifer Test: (Nell Devel Description: Used Submer	244 - 270' 60'-230.86' Depth +2.00 - 229.9 229.9 - 200.9 201.9 - 200.9 opmen sible pump to	9/5/ 9/5/ Thread F480 F480 F430 THE F430 P430 P430 P430 P430 P430 P430 P430 P	O/O/O/O/O/OMPLET Slot Size	Type Colorado SO# bags Colorado Silica SAND SO # BUCKET BENTONITE PELLETS BENTONITE CRUMBLES PORTLAND CEMENT CTIVITIES Well Abandoned:	Annual Sea/Filter Paci 272.0 - 216.9 218.9 - 213.03 213.03 - 10.3 10.3 - 0	38 200	Size 10-20 10-20 10-20 10-20
Dectral Gamma Vertron Moisture SizeNVI.Material 4"ID SS 304L Riser 020" Cont. 4" SS 304L Wing Wrop Scale. 4" SS 304L Symp Aquifer Test: (Nell Devel Description: Used Submer 3 9pm wiff 14:392 drag	Depth + 2.00 - 230.86 ' Depth + 2.00 - 229.9 - 204.9 - 204.9 - 206.9 - 206.9	9/5/ 9/5/ Thread F480 F480 F430 THE F430 P430 P430 P430 P430 P430 P430 P430 P	O/O/O/O/O/OMPLET Slot Size	Type Colorado SO# bags Colorado Silica SAND SO # BUCKET BENTONITE PELLETS BENTONITE CRUMBLES PORTLAND CEMENT CTIVITIES Well Abandoned:	Annual Sea/Filter Paci 272.0 - 216.9 218.9 - 213.03 213.03 - 10.3 10.3 - 0	38 200	Size 10-20 10-20 10-20 10-20
Dectral Gamma Neutron Moisture SizeMi./Material H"ID SS 304L Riser 4" SS 304L WARP SCARL 4" SS 304L Sump Quifer Test: (Nell Devel Description: Used Submer	244 - 270' 60'-230.86' Depth +2.00 - 229.9 229.9 - 200.9 201.9 - 200.9 opmen sible pump to	9/5/ 9/5/ Thread F480 F480 F480 F480 F480 F480 F480 F480	O/O/O/O/O/O/O/O/O/O/O/O/O/O/O/O/O/O/O/	Type Colorado SO# bags Colorado Silica SAND SO # BUCKET BENTONITE PELLETS BENTONITE CRUMBLES PORTLAND CEMENT CTIVITIES Well Abandoned:	Annual Sea/Filter Paci 272.0 - 216.9 218.9 - 213.03 213.03 - 10.3 10.3 - 0	38 200	Size 10-20 10-20 10-20 10-20
Dectral Gamma lectron Moisture Size/WI./Material 4"ID SS 304L Riser 1" SS 304L Wind Wind State 4" SS 304L Sump Quifer Test: (Nell Devel Description: Used Submer 3 gpm with 14:392 dra Sct at 263.0 bgs.	244 - 270' 60'-230.86' Depth +2.00 - 229.9 229.9 - 266.9	9/5/ 9/5/ Thread F480 F480 F480 F480 F480 F480 F480 F480	O/O/O/O/O/O/O/O/O/O/O/O/O/O/O/O/O/O/O/	Type Colorado 50# bags Colorado Silica SAND BENTONITE PELLETS BENTONITE CRUMBLES PORTLAND CEMENT CTIVITIES Well Abandoned: Description:	Annual Sea/Filter Paci 272.0 - 216.9 218.9 - 213.03 213.03 - 10.3 10.3 - 0	38 200	Size 10-20 10-20 10-30 1
Dectral Gamma lectron Moisture Size/Wi./Material 4"ID SS 304L Riser 1" SS 304L Sump H" SS 304L Sump Quifer Test: (Nell Devel Description: Used submer 3 gpm with 14:392 dra Sct at 263.0 bgs.	244 - 270' 60'-230.86' Depth 12.00 - 229.9 229.9 - 264.9 264.9 - 266.9 Copment sible pump to with p	9/5/ 9/5/ Thread F480 F480 F480 F480 F480 F480 F480 F480	O/O/O/O/O/O/O/O/O/O/O/O/O/O/O/O/O/O/O/	Type Colorado 50# bags Colorado Silica SAND BENTONITE PELLETS BENTONITE CRUMBLES PORTLAND CEMENT CTIVITIES Well Abandoned: Description: RVEY DATA Protective Casing Elevation:	Annual Sea/Filter Paci 272.0 - 216.9 218.9 - 213.03 213.03 - 10.3 10.3 - 0	38 200	Size 10-20 10-20 10-30 1
Dectral Gamma Neutron Moisture Size/Wi./Material 4"ID SS 304L Riser 4" SS 304L Wind Wind Swain 4" SS 304L Sump Aquifer Test: (Nell Devel Description: Used Submer 3 9pm with 14:392 dra sof at 263.0 bgs. Date:	244 - 270' 60'-230.86' Depth 12.00 - 229.9 229.9 - 264.9 264.9 - 266.9 Copment sible pump to with p	Thread F480 THE F480	OMPLET Siot Size	Type Colorado 50# bags Colorado Silica SAND BENTONITE PELLETS BENTONITE CRUMBLES PORTLAND CEMENT CTIVITIES Well Abandoned: Description: RVEY DATA Brass Cap Elevation:	Annual Sea/Filter Paci 272.0 - 216.9 218.9 - 213.03 213.03 - 10.3 10.3 - 0	38 200	Size 10-20 10-20 10-30 1
Dectral Gamma Jectron Moisture Size/Wi./Material 4"ID SS 304L Riser 22" Cont. 4" SS 304L West Wasp Sween 4" SS 304L Sump Aquifer Test: (Well Devel Description: Used Submer 3 gpm with 14:392 dra Sct at 263.0 bgs. Date: Washington State Plane Coordin	244 - 270' 60'-230.86' Depth 12.00 - 229.9 229.9 - 264.9 264.9 - 266.9 Copment sible pump to with p	Thread F480 F480 F480 F480 F480 F480 F480 F480	OO/ OO/ OOMPLET Slot Size OOTHER A //4/O/ - WELL SU	Type Colorado SO# bags Colorado Silica SAND BENTONITE PELLETS BENTONITE CRUMBLES PORTLAND CEMENT Well Abandoned: Description: RVEY DATA Protective Casing Elevation: Brass Cap Elevation: TS/REMARKS	Annual Sea/Filter Paci 272.0 - 216.9 218.9 - 213.03 213.03 - 10.3 10.3 - 0	38 200	Size 10-20 10-20 10-30 1
Dectral Gamma Jectron Moisture Size/Wi./Material 4"ID SS 304L Riser	Depth +z.00 - 230.86' 129.9 - 224.9 264.9 - 266.9 Ofment sible pump to wdown with p	Thread F480 F480 F480 F480 F480 F480 F480 F480	OMPLET Siot Size	Type Colorado SO# bags Colorado Silica SAND BENTONITE PELLETS BENTONITE CRUMBLES PORTLAND CEMENT Well Abandoned: Description: RVEY DATA Protective Casing Elevation: Brass Cap Elevation: TSIREMARKS 2 3 3 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	Annual Sea/Filter Paci 272.0 - 216.9 218.9 - 213.03 213.03 - 10.3 10.3 - 0	38 200	Size 10-20 10-20 10-20 10-20
Dectral Gamma Jectron Moisture Size/Wi./Material 4"ID SS 304L Riser 22" Cont. 4" SS 304L West Wasp Sween 4" SS 304L Sump Aquifer Test: (Well Devel Description: Used Submer 3 gpm with 14:392 dra Sct at 263.0 bgs. Date: Washington State Plane Coordin	Depth +z.00 - 230.86' 129.9 - 224.9 264.9 - 266.9 Ofment sible pump to wdown with p	Thread F480 THRE F480 F480 F480 F480 F480 F480 F480 F480	O//O//O//O//O//O//O//O//O//O//O//O//O//	Type Colorado Soft bags Colorado Soft bags BENTONITE PELLETS BENTONITE CRUMBLES PORTLAND CEMENT Well Abandoned: Description: Brass Cap Elevation: Brass Cap Elevation: TSIREMARKS Soft bags At the bags At the bags Portland Cement RVEY DATA Protective Casing Elevation: Brass Cap Elevation: TSIREMARKS	Annual Sea/Filter Paci 272.0 - 216.9 218.9 - 213.03 213.03 - 10.3 10.3 - 0	38 200	Size 10-20 10-20 10-20 10-20
Dectral Gamma Jectron Moisture Size/Wi./Material 4"ID SS 304L Riser 4" SS 304L Wind Wind Survey 4" SS 304L Sump Aquifer Test: (Nell Devel Description: Used submer 3 gpm with 14:392 dra Sof at 263.0 bgs. Date: Washington State Plane Coordin Val. Sense: Silica sand = 2.43 ft 5 bentonite	244 - 270' 60'-230.86' Depth 12.00 - 229.9 229.9 - 200.9 201.9 - 200.9 copment sible pump to wdown with p ales: 33 bags * Crambles, 131	Thread F480 THRE F480 F480 F480 F480 F480 F480 F480 F480	O//O//O//O//O//O//O//O//O//O//O//O//O//	Type Colorado Soft bags Colorado Soft bags BENTONITE PELLETS BENTONITE CRUMBLES PORTLAND CEMENT Well Abandoned: Description: Brass Cap Elevation: Brass Cap Elevation: TSIREMARKS TOGG = 93.54 fc. 100	Annual Sea/Filter Paci 272.0 - 216.9 218.9 - 213.03 213.03 - 10.3 10.3 - 0	38 200	Size 10-20 10-20 10-30 1
Size/WI./Material Weytron Moisture Size/WI./Material 4"ID SS 304L Riser 4" SS 304L Wind Wind Survey 4" SS 304L Sump Aquifer Test: (Nell Devel Description: Used Submer 3 gpm wiff 14: 92 dray Sct at 263.0 bgs. Date: Washington State Plane Coordin Well Sales: Silica sand = 2.43 ft. bendante	244 - 270' 60'-230.86' Depth 12.00 - 229.9 229.9 - 200.9 201.9 - 200.9 copment sible pump to wdown with p ales: 33 bags * Crambles, 131	Thread F480 THRE F480 F480 F480 F480 F480 F480 F480 F480	O/O/O/O/O/O/O/O/O/O/O/O/O/O/O/O/O/O/O/	COLORADO SOT DORS COLORADO SILICA SAND BENTONITE PELLETS BENTONITE CRUMBLES PORTLAND CEMENT CTIVITIES Well Abandoned: Description: RVEY DATA Protective Casing Elevation: Brass Cap Elevation: TSIREMARKS 20.38 K2 Dentanite COLORADO SOLUTION COLORADO TORS 20.38 K2 DENTANITE TORS 20.38 K2 DENTANITE TORS 20.38 K2 DENTANITE TORS 20.38 K2 DENTANITE TORS 20.30 K2 SOLUTION TORS	Annual SeaVFilter Pack 272.0 - 218.9 218.9 - 213.03 10.3 - 0 Yes: No:	38 593	Size 10-20 10-20 10-20

P.C. (cont.) = 16.71 ft

WEL	L SUMMARY SI	HEET		Page 1 of 2	
Well ID: c3393			: 299-0	Date: 08 27 01	
Location: Eggs of 241-4 Tank F					
Prepared By: cmartine2/Jess Hocking	Date: 05 130101	Project: CYOI RCRA Drilling Reviewed By: Wheekes Date: 9/20/01			
Signature: Charles Martine	14-	Signature:	143	loo hes	
CONSTRUCTION DATA	4		1 1/ V - CO	GEOLOGIC/HYDROLOGIC DATA	
Description	Diagram	Depth in Feet	Graphic Log	Lithologic Description	
6"ID SS 304 Protective casing 3 base		0 —	Balalatarates	0-2.5 sorby gravel (59)	
4"ID SS BOUL RISER		_	0.0°	25-70 gravelly SAND (Q5)	
+2.00' -> 229.9' bgs.		_		20-110 sandy BRAVEL (36)	
		_	83.9	110-190 gravelly SANO (95)	
4"ID 55 3044 0.020" Conf. Wire		_	<u> </u>	19.0'-31 0'sitty sandy GRAVEL (MOG)	
Wrap Screen.		40	0	340-385 Sandy GRAVEL (SG)	
229.9 bys -> 264.9 bys				38.5 440 gravelly SADD (95)	
		-		445-455 Sandy Gravel (&G)	
4"ID SS304L Zft. Sump		_		45.6- 500 comented sity Gravel	
264.9 -> 266.9 bys		_		son-ezo' gravelly sand (95)	
		80 —	Transaction of the second	520-580 SANO (6)	
Colorado Silica Sand 10-20 MESH		_	14 To 14 To 14	58.a' - 59.a' SIIT (m)	
218.9 bgs -> 272.0 bgs		_		592'-67.0' SAND (s)	
		_		67.0'-67.5' sandy 57.7(sm)	
1/4" Bentonite Pellets		_		625-680' SI LT (m)	
213.03'bgs -> 218.9'bgs		0 د ا	1367 743	48.0° -690° 5 And (5)	
3		_		64.0-70.6' SILT (m)	
Bentonite Crumbles		_		70.5 - \$1.5 SAGO (5)	
10.3' bgs -> 213.03 bgs		_	- <u>-</u>	815- 88.0 Sandy SILT (Sm)	
		_		88.0'-97.5' silty SAND (ms)	
Portland Cement Grout		140-	0000	975'- 1030' sand (s)	
0' -> 10.3' bas.		'• _	<u>₹</u> 270	103.0'-1318 SUTU SAND(MS)	
3.			_ 50.00 _	1318-144.5 SILT (m)	
			<u>∵</u> o_o_c	1515 - 144.5 SIGI CM	
			500	Sand	
All depths are in fext		`	5.0 0	HISCO - 100 O HIGHTLY AT ITY OF TAVELLY	
		200-	0.0	STADO - 105 SITTY SONDY GRAVED	
below ground surface]			
0.1. 75.00 0.00			1220	<u> </u>	
ALL TEMP. CASING		¥ 230.9	0,0	<u> </u>	
REMOVED FROM GROUND.		<u> </u>	<u> </u>	<u> </u>	

					Page a of a
WE	LL SUMMARY SI	HEET			Date: וסורב ופס
Well ID: C3393		Well Name	<u> </u>	219-44	
Location: Eusz of 241-U Tank F	<u>qrm</u>	Project: c	YOURC	RA prilling	
Prepared By: C. that i nea	Date: 08(30101	Reviewed I	By: DCC	Weekes T	Date: 9/20/01
Signature: Charles Marting		Signature:	XC	Ukehes	7 7
CONSTRUCTION DA	ATA	Depth in	•	SEOLOGIC/HYDRO	DLOGIC DATA
Description	Diagram	Feet	Graphic Log	Litholog	ic Description
				2342 - 3922 2029	sity sandy gover
					9
		370 —		T0= 272.	(ms6)
		-			
		-	-		
ALL TEMP. CASING					
REMOVED FROM GROUND.			_		
All depths from grandsut	J	[

	22102	WELL SURV	VEI D	Dronovad	Date Game D	Wagner, P.L.S.
ERC Project:	22192				By: Gary B. Rogers Sur	
	11/10	<u></u>		Requestor		
Date Request	ed: 11/19/	01		Kequestor	T -	
Date of Surve	y: 12/05/0)1		Surveyor:	Rogers Surv	veying, Inc.
ERC Point of	Contact:	Mr. Robert Bone			o. Point of Co	ntact:
D	CM				agner, P.L.S. l Datum: NA	D83(91)
Description o	I WORK:					
		n groundwater we			Datum: NAV	
in 200W & 20	ЮE:Areas.			Units: M		
					Area Designa	
Coordinate S	ystem: Wa	ashington State P	lane C	oordinates	(South Zone)	
Horizontal C		numents:				
HSWB-037 & Vertical Con		ments:			· · · · · · · · · · · · · · · · · · ·	
2W-43 & HS	* *	neuts.				
Well Name	Well ID	Easting	Nor	thing	Elevation	
299-W19-44	C3393	566896.95	13	55041.97		Center of Casing
				~	207.277	"X" on Rim
	-	566896.95	13	35042.26	206.520	Brass Cap
				**		
Notes:		1				
Carrier C4	ntoment:			Certifica	tion Seal	
Surveyor Sta		essional land surve	eyor			
*	-	ashington (Registi				
=		that this report is				
- NO. 20440). N						
	ey performe	d in December, 20	101			
on a field surv		d in December, 20 on and that the date				

BHI-EE-202 (09/98).

			вс	REHOLE LOG	•	Page / of 10
ماا ال			- 1		Location:	1149.6.2007
	<u> 3393</u>			ame: 299-19-44	Location: East sid	
oject: C	1015		Dind	9 (nt: Ground Surface
1	San	nple	<u> </u>	Sample D	escription	Comments:
Pepth (Ft.)	Type No.	Blows Recovery	Graphic Log	Group Name, Grain Size Distrit Moisture Content, Sorting, Ang Size, Rea	oution, Soil Classification, Coloularity, Mineralogy, Max Partic ction to HCl	Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
o —				0' → 2.5': San	dy GRAVEL -	Carbon steel casi
_	Drive		908	crushed rock dri	lling pad	113/4"/ 101/4", cable
_	barrel		990		<i>y</i> , <i>-</i>	tool Drive barre
_	₩		o°c	2.5' > 7.0' : 6	ravelly SAND	83.0' → 5.5': Split
_	Split	75% tec.	0.4	l	•	
-	tube #1	likers	6.6	(g5); 25% grav	, // \ .	tube #1. Lexan like
5 	<u> </u>	moisture	∤ ∵⊙∵∖	5% silt. 10YR		, moisture and arch.
-	ST # 2	archive	/ O .	poorly sorted	; Sand SA, gravel	all for PNNL
_	5.0 -7.5	woisty		SR-SA, 60-70	% ofz/feld, 30-4096	
_				basalt/mafic: L	veak txh HCl.	8 5.0' → 7.5': ST #.
_	ST.	50%	ZOE!			Lexan liners + moi
	#3	Lex/moist		70'-> 110' C	andy GRAVEL /so	27.1
10 -	AT #11	12-62	180	d .		
-	- ST #4	100% rec.	000	·1 · · · · · · · · · · · · · · · · · ·	-60% Sand, tr-5%	® 8.0'→ 10.0'
-	- moisture			silt Gravel SR-R,	predom med-v. cse pe	6, ST #3; Lexan line
-	ST #5	(shoe) 80%	-	Sand SA, predom	csc. 25 / 5/2 (gryich b	in) moisture & archi
-	- lay liver			dry poorly sorted	1: 40% base 1t, 60%	10.5 → 13.0': ST #4
15 -	moisture	1	ح. ا	gtzite/granitic im	ax aravel 6-7 cm.	d, 8,8 : background
	- ST # 6		$\dashv ::::::::$	weak run HCl.		Ø 13.0' → 15,5': ST #5
	- lan lines	10070			avelly SAND (g S	
•	noistui	- Shoe	- 60	5]		4 0
-	ST #7				30% sand. Sand pro	1 .
•	- Iran liher	1	0:02	i v. cse, Ang, ba	salt rich. St-mois	
20-	-archive			to dry, no rxn	HC1. [16'→17': clean So	md 817.5 -> 20.0': ST +
	- ST #8	30 10	N 1/2 7/0	019'-> 31' : Silty	Sandy GRAVEL (m.	s6) rad: background
	noist.		- 500	(Z)	Sand, 15% Silt 10Y1	25/3 820.0' → 22.5': ST#8
	ST # 9	- Shoe	1 X 2 7 7	9/1 //	ly sorted, gravel SR-	
	_ -lex lih	101		≪!		100 0 - 1 - 1 - 4
	-moist.	"]	_ 7°	<i>O</i> ,	granific/qtzite, max s	1/2e 22.3 - 23.0 · 31 "
25-	tchi	ye - 5400		over 8 cm; Strong	rxa HC1.	<i>a</i> 1 ,
	_ ST#	1 100	, 00	22': dry other	wise as above	© 25,5 → 28,0': ST #1
	- lox. lin			o sill content	decrease to ~10%	tad: backgroun
	m o i 5tu	-Shoe			er moist, for iron a	xide \$28.0' → 30.5': ST
	ST#	loo!		staining.		rad: backgrow
Repor	rted By:		Walker	1	seviewed By: DCWee	kes
Title:	6-	ologis			itle: Geologist	
<u> </u>		210817	1 10		2007/	pate: /0/23/
Signa	iture:	TA L	ken	Date: 8-8-01 S	ignature: SC Welk	Date. 1423/0

			R	OREHOLE LOG		Page <u>2</u> of <u>10</u>
			ים	OKCHOLE LOG		Date: 8-8-01
Well ID:		393		lame: 299 - W19 - 44	Location: 200 w / Eas	
Project:	CYOI	RCR	A DI	illing	Reference Measuring Point:	Ground Surface
	Sa	mple		Sample Des	cription	Comments:
Depth (Ft.)	Type No.	Blows Recovery	Graphic Log	Group Name, Grain Size Distribut Moisture Content, Sorting, Angula Size, Reactio	rity, Mineralogy, Max Particle	Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
30	ST # 11	-Shoc -	900	silt content decreasi	n 0	Cable tool: 113/11/10/1
_	ST #12	60%	00° 20°		• • • • • • • • • • • • • • • • • • • •	
	-lexen lines		980%	31' - 200-16	COULT / C	Casing #
_	- moistage	- Shoe .	208	31'-> 38.5'; Sandy		[©] 30.0'→32.5': ST #12
_	ST #13	65%	068	60% gravel, 35% sand		Rad: background
-	lex. liners	tec.	° 0°	10% cobble, 50% v.cse	-cse peb, 40% med-	ovm (detect
35	-archive	- Shoe -	900	Y. fn peb; Sand predo	n csc-med. 10YR5/2	® 33.0' → 35.5': ST #13
_	ST #IU				to dry, poorly sorted.	rad: background
l <u> </u>	-lex. liners	100%	B DZB	Gravel R-SR, sand S	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	835.5 → 38.0': ST #14
	- moist.	- 5400-	900		,	
• -	ST #15	100%	000		~ 10 cm; weak	rad: background
_	-lex.liners	rec.	0			\otimes 37,5 \rightarrow 40.0': ST *15
40 -	Tarchive ST #16	-5600	Ö 6	-gravel content	decrease	tad: background.
_	-lex.liker	10070	· .	38.5 ->44.8 : Grave	IIV SAND (aS)	\$40.0' → \$42.5': ST #16
_	-moist.	tec.	0	25% gravel, 75% Sand	,	rad: background
	57*17	- Shoe -	, e o	, ,		1900 PUCKGround
_	- her liner - mai sture	100 10	0 0	similar to saudy Gra		<u> </u>
_	- archive		% 0 ^O o	Sand v.cse-cse, SA,	·	19 425-45.0:57 17
45	21-419	- Shoe -	500	440- 46,5' sandy Gra	wel (s6). Similar to	rad@bookground.
_	Lex. Itnen	100°60	30-10	31 description		·
	moisture	- Shoe -	7265	45.6'- 50.0' cemented	silty oravel (ma)	® 45- 47.5 ST#18
_	57 ±19		9-1-19		, , , ,	
	lex liner	100%	10 1-10	Silt - strong Nan HCI. V		non - concertous
<u></u>	archive.	1-cc	1-1-62	,	sible iron oxide staining	D / calide
50-	ST 12 20 LEX lines	-3ho	9.0.0	Gravel, poorly sorted, SA	. 60° to gtr (other)	47.5 - \$0.0 ST 19
-	שיושלעיל	100°/0	000	40 % basalt . 10 YR 5/1	gray)	
-		Shor -	0	50.0 - 53 Com Gravello So	md (GS) 25% gravel	850.5'-52.6 51 ± 20
_	STE 31 lex. liner	3402	0. 6.		cravel 70/0 sm	
	molstere.	100 °C	o no			
[_]		shee -	on: :0	pebbles, 25 % med pebble		D 52-5 -55-0 ST 21
5 <i>5-</i>	87 TZZ		6	SB, mod sorted; sand uf	?-cne, 10% vf-f,	·
-	lex liner mutelem	100%	l o	40°10 med, 50°10 cse, so	me mica, SA, felsics	80 55 6 - 57,5 st €20
-	.	rec		60%, basalt 40%, 1041	25/2 (grayish brown)	
-	ST M 23	100°10		KIN-1 HOLE 1	onch seded	@ 575'-60.0' ST =33
l _	שינייים	بعد. ا		32 ,	501-551	
Reported	d Bv:	L.D.W	alkan			
Title:			١	Title	· Dowedie	
		ogist	1 <u> </u>	9	Geologist	
Signatur	e: 12	Wolk \	cmarti	Date: 08 09 01 Signatu	re: (XX Alcoher	Date:/0/23/or
				$\boldsymbol{\varnothing}$	•	/ '

Signature Content, Sorting, Angularity, Mineralogy, Max Particle Sampling Tool, Sample Size, Reaction to HCI Size, Water Level Size Size Size Size Size Size Size Size				ВС	REHOLE LOG	·	Page 3 of <u>VO</u> Date: 08(08(0)
Reference Measuring Point & Ground Surface Sample Sample Sample Sample Sample Description Graphic Type No. Recovery No. Recovery Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl Size, Water Level Size, Water Level Size, Water Level Size, Reaction to HCl Size, Reaction to HCl Size, Water Level Size, Reaction to HCl Size, Reaction to HCl Size, Water Level Size, Reaction to HCl Size, Water Level Size, Reaction to HCl Size, Size, Reaction to HCl	Vell ID:	3393		Well N	ame: 299-w19-44	Location: East side of a	41- U Tank farm
Sample Sample Description Comments: Type Blows No. Recovery No. Recovery Blows Recovery Size Reaction to HCI Size Reaction to HCI Size Reaction to HCI Sample Description Graphic Log Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCI Size, Reaction to HCI Sample Description Graphic Log Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCI Size, Water Level Sample Description Depth of Casing, Drillin Method, Method of Driv. Method, Method of Driv. Method, Method of Driv. Sample Mineralogy, Max Particle Size, Reaction to HCI Sample Description Size, Water Level Size, Reaction to HCI Sample Description Depth of Casing, Drillin Method, Method of Driv. Method, Method of Driv. Sample Mineralogy, Max Particle Size, Reaction to HCI Sample Description Size, Water Level Sample Description Size, Cepture Hold, Sample Size, S	roject:	C401 '	RCRA 1				
Silver Bear Log South Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Sampling Too,					Sample Desc		
18 - 59 2 512 1 100 5 100 6 10	* .				Moisture Content, Sorting, Angular	ity, Mineralogy, Max Particle	Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
Les was watsture too's material too's arbite to the month test too's arbite too's	<u> ۵۵ —</u>	57 23	-500-4		58-59 2 5:17 1055 (n	~) 95 /0 5:17 5 /0	1 60 0'0 60 6 ST 34
Sample muist. Strong routel. 1048 417 browning 1) 1	_						37 40.0 - 67.3 31.27
1		mutotue		200	}	(light)	
16. U. U. 16. 17.0 5and (5) 95 6 sand, 5 65 11. 18 625 - 1650 5T	_	-7-4-2	- shoe -	2			
### 1 100 %	_	ICA. Line	٠,		(20'- 67.0' Sard (5) 95	sto sand, 5 to silt.	
57 # 30 15 # 300 16 # 300 17 # 300 18 # 30	_				trace aravel force.	15 10 f. 35 10 med	
100 100	ـــ که		-sno-e -		, ,	•	X) 65.0 -1.7.5 5 T 36
ST#37 100 to 10		lex liner	, ao °/o		1	•	12) W3.0 - 14 1.0 - 31 - 30
ST#37 100 /0 Send @ 165' - Strang ran #C @ 17.5'-70.0' ST# 2 100 /10 100 /0 10		malature				K 215 (Grayish prood)	
100 to 1	-	<u> </u>	-3hoe-	C-1-1-	Slight rxn to HCI.		
The state rec.	-		00.00		sand @ 65' - strong ran	401	@ 67.5 -70.0 ST 27
The state of the s	-	1		=101=	(5m)	55°10 5: 12, 45°10 5978.	
- lex liner 100 % 100 % 100 gtz (ather) 35 10 basalt, 104R4/2, light \$20.0-73.5 st 21 moisture rec. 517 39 1ex liner 90 6 100.5 - 28.8 100 strong ran HCl. 5R 1ex liner 90 6 100.5 - 28.8 100 strong ran HCl. 5R 1ex liner 90 6 100.5 - 28.8 100 strong ran HCl. 5R 1ex liner 90 6 100.5 - 28.8 100 strong ran HCl. 5R 100.5 - 20.8 100.5 strong ran HCl. 75 : 6rab sample ran liner strong ran HCl. 75 : 6rab sample ran liner ran HCl. 104R6/3 Pale Brown. 100.5 - 20.5 - 20.5 5 : 15 (m) 90 6 5 : 15. 10 5 and 5 17.5 + 80.6 : 57 in ran HCl. 104R6/3 Pale Brown. 100.5 - 20.5 5 : 15 (m) 90 6 5 : 15. 10 5 and 5 17.5 + 80.6 : 57 in ran HCl. 104R6/3 Pale Brown. 100.5 - 20.5 5 : 15 (m) 90 6 5 : 15. 10 5 and 5 17.5 + 80.6 : 57 in ran HCl. 104R6/3 Pale Brown. 100.5 - 20.5 5 : 15 (m) 90 6 5 : 15. 10 5 and 5 17.5 + 80.6 : 57 in ran HCl. 104R6/3 Pale Brown. 100.5 - 20.5 5 : 15 (m) 90 6 5 : 15. 10 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	ص ٥٦	_1	- 4h0e -	 	· •		
brownish aray strong rxn HCI. SR 573 99 142 tinar 90% The tinar rec. Stightly comented well sorted 104R bl2 30% 57#30 100% 168.0 - 69.0 Sand(S) Samedescription as ao'. 169.0 - 69.0 Sand(S) Samedescription as ao'. 179.0 Sand(S) Samedescription as ao'. 179.2 Sand(S) Sand(S) Samedescription as ao'. 179.2 Sand(S) Sand(S)			١.	3-3-3	4	•	_ /. / # _
ST# 39 100% Slightly comented well sorted to 4 lot 1 lot 2 30% St. 5 10 sand	_	1		37,443		•	8c 75 51-0.0-13
Textiner qo's moisture rec. Slighty comented well sorted to YRight 30% Archive snoe basalt 70% atz(other) SR, strong rxn HCl 75': Grab sample lex linet rec. 64.0-69.0' Sand(s) same description as ao'. For a rchive - string rec. Slighty comented well sorted to YRight 30% For a rchive basalt 70% atz(other) SR, strong rxn HCl 75': Grab sample 18.0-69.0' Sand(s) same description as ao'. For a rchive - string rec. Slighty comented well sorted sample - string strong 75.0' > 77.5' ST - string strong - string string strong - string string strong - string string strong - string		-	-shoe-	-	brownish gray, strong rx	n HCI. SR	
The structure of the st	-		٧.		(68,0 69.0 Sand (5) 5:11	t(n)95 10 s: It 5 10 san	
Archive Snoe basalt 70% at2(other) SR, strong rxn HCI 75': Grab sample - ST#30 100% rec. 6 49.0' Sand(s) same description as ao'. for archive - lex livet shoe Shoe 64.0' Silt (m) 90% silt, 5% sand, 075.0' > 77.5' ST - St # 31 100% S% gravel, cemented - Sand Gravel poorly - lex liver rec. Sorted SR - SA . 75% at2(other) 25% basalt. Strong 077.5' > 80.0': ST - Archive - store. Cxn HCI. 104R6/3 Pale Brown. - working - moletum 0 % cannot see 100% Silt (m) 90% silt, 10% Sand ST#32(86-82.5') - Tax uner 100% ST#33 (82.5'-85') - Tax uner 100% ST#33 (82.5'-85') - ST#33 - Ander 100% ST#33 (82.5'-85') - Ander 100% ST#34 (85'-815')	_	1			: slighty comented well son	ted 104R612 30%	872.5 -75.0 ST 39
- ST#30 100% rec. 69.0 Sand(s) sandescription as ao'. for a rchive like liket saisture shoe: 69.0-69.5 S; It (m) 90% si It, 5% sand, \$75.0 > 77.5 ST - ST#31 1009. Sologravel, commented. Sand Gravel poorly. - lex liket rec. sorted. SR - SA.75% of stadhed 15% basalt. Strong \$77.5 > 80.0 : ST in the said st	75 _	Archive	1	1.4.4			1
Tex liner Shoe Sh	_	ſ			4	`	
- ST # 31 100% - St # 31 100% - Lex liner rec. - Archive - Store ran HCI. - Loyr 6/3 Pale Brown. - Liners - Lex liner rec. - Lex li			-1		.1		
- lex liners -	_	maisture	- Shoe -		:		13.0 -> 77.5 51 730
South State South State South State Stat	-	1	110		5% gravel, commented. 5	sand Gravel poorly	
80 - Archive - Store - CAN HCI. 104R6/3 Pale Brown. - CAN HCI	-				Sorted SR -SA.75 % atz(d	the 25 10 basatt. Strong	\$77.5' → 80.0': ST #31
- 10 feeding D 6 10 15 15 15 16 10 16 50 1	68	- Archive	- 3kor.	4000		7	
- moisture Vf. well sorted SR 1048 613. Strong rxn HCl. ST#33 (82.5'-85') Tax liner wo % box basatt, 70% qtz (other)	"		T 0%				(20/20/20/20/2)
- 123 Ahore - Vf. well-sorted, SR 1048 613. Strong rxn HCI. - 124 Uner wo % box of box of the control of the c	-	- i	12 C.	-			
12x Uner 100% 100% 100% 100% 100% 100% 100% 100	•	_	- a hore -		vf, well sorted SR 104R	613. Strong ran HCI	
- and the rec 175 70.5 - 81.5 Sand (s) Same description as 60		- I ex line	یرہ ا۳		30 6 basatt, 70 % gtz(other)	57#33(82.5-85')
15' NOT 15' NO			٦		70.5 - 81.5 Sand (s) 50	ime description as 60	
The Total Transfer of the Take week to Stroke	85 -	_			75' 401 404 100-6		57#34 (85'-87.5')
37-24		31 334	´ l			/ > 0/	
- 2 hoers 100% 815 - 68. Sandy Sit (sm) 45 10 Sand	'	- d live		1.575.575.600	181.5 - 00. 5andy 5		
- mexture super 55% silt sand well sorted vf-f. SR moisture for from		- meretur	SHOE		\$ 55 10 5112 Jand - we	11 sorted vf-f. SR	moisture fin from shi
- 55#35 100% 100% basalt, 70 % at 2, 104R1013, Pale Brown			100%		# 30% basalt 70% otz.	104R613. Pate Brown	
- a liners recovery tomong ran HC		_ 2 Line	recover	, 除隐	38	·	
Perceted By: A Conference By: Dallankes	Report	ted By: ^	\0.0clo	~ ~ · · · ·	Land Poulo	wed By: Dallhooko	2
Title: 60 Accient				// /	THE PULL OF		
			~ /	C7 40109	Carl et	- 1 kg \ / //	Deta: /a /a /
Signature: Charles Martine Anguadate: 08/00/01 Signature: NC Weeker Date: 10/23/	Signat	nte:600	rèrase	ranting		ture: Soc'Aleella	L Date:/0/23/0/
08/13/01 BHI-EE-183 (12/97)	BHI EF	193 (43/07	,	7	05/13/01		•

BOREHOLE LOG							Page 4 of 10
Well ID:	C 3 3 9 3		Well N	Well Name: 299-ω 19-44			-01/2/01
		روه ٥٠		Name: אמחפ: אמחפ: אמחפ: אמחפ: אמחפ במשני המוש במשני לא במשני במשני המוש במשני לא במשני במשני במשני לא במשני במשנ			
Sample			Sample Description		Comments:		
Depth (Ft.)	Type Blows No. Recovery		Graphic Log	Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCI		Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level	
90 -	\$5#35	ZHOE		92.5' Sandy Silt (Sr	~) <	Ulti Ascharina to	Moisture fin from SHOE
-	15 H36 lextinet	100%		40%, sand 60°10, Res			Archive @ 90' (1 pnt)
_	moistive vec			88.0-97.5' Silty san			
95	ST #37	SHOE		grains are SR-SA, 35%		•	+ moisture +in
	sex lines	•		dry , poorly sorted HATE S			V85#37(925-95)
	archive	SHOE		7,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			lex'
_	ST #38	100%.					Sv #38 (95-97.5)
_	moisture	SHIFE	÷				
_	ST #39	100%		97.5-103 SAND C	ड)	90%5 40%siH	SH 39 (97.5-120)
-	moisme	rec		15% for 40% med 4	_		
100 -	ST 440	SHOE		40%,9+260%, wel		, ,	SK #40 (100'-102.5')
-	- ly .liner	100%.		164R7/2 (1+ gray).			
-	- moist.	r-cL	:: ; <u>⊹</u>				
-	ST 41	SHOE		103-1318-5,144 SAND	D/m	S) 85%5 15%m	SX+4 (102.5-105)
	- Hiner					moist, well sorted,	
105-	ST 42	SHOE		Strong rxn HCl.			
-	- Winer	100%					5x47 (105-107.5)
	most.	rec					
-	- 57 43	5++0€ 100%					
	ly lines	1	-				5x 43 (107.5- 110)
\o_	achva	SHOE					1- (10 (13 - 110)
١.	- IX-liner						
	- maist	rec		112- cont. Der 90%	1 0	1 4 111/	5x44 (110-117.5)
	- 51 45	3406	7::::::	Sand = 20 vs = cse	•	•	(1504)
.	- lex line miss b	100%.			-	ufn predum.	1000
115-	archive		։	3800 7	<u> </u>	vir presum.	sv (12.5-115')
	ST 46 lexan	100%		# # ## ## ## ## ## ## ## ## ## ## ## ##		· 1.6 · · · · · · · · ·	
	Liners	recovery	57.35	liners @ 116' Bo		dike in conter of	
	_ 0650 h	S Still		Timers & 116 , por	25 110	ot snow e 116	moisture tin @ 117.5
	Lexan						RCTAM - < detect
Report	ed By: 7	m Car		A Toda	Review	red By: DC Weekes	
Reported By: JM Faurate C. Trice Reviewed By: DCWeekes Title: Geologist Title: Geologist							
Signature: Infauroto/ New Date: 8/4/01 Signature: M. Gleakes Date: 19/23/01							

			ВС	REHOLE LOG			Page <u>5</u> of <u>to</u> Date: 08/15/01
Well ID:	C33	93	Well N	ame: 299-w19-4	4	Location: East of 241	-4 Tank Farm (200 ales
Project:	CYOI	RCRAZ				Reference Measuring Point	Grand Surface
		nple		Samp	e Des	cription	Comments:
Depth (Ft.)	Type No.	Blows Recovery	Graphic Log	Moisture Content, Sorting,	Angula	ion, Soil Classification, Color, rity, Mineralogy, Max Particle n to HCl	Sampling Tool, Sampler Size, Water Level
120-	0731 hrs	SHOE		Continues as v	f 60 f	and med grad sand	Archive & Grat moisture fin @ 120'
	SS # 48 Lexan	100%	***			e is a mod-sq rxn to	
_	liners 0801 ha	recovery				nodules within the	maisture tin @ 1285
_	SS#49	100%		sund. It is it g		, moderately sorted,	
125-	0830 ho	recovery SHOE		dry			Archive & Grab moisture fin @ 125
_ _	lexan Liners	85% recovery					moisture tin @ 127.5'
_ 	exan Liners	85%					INSUNCY- 0.00 ppm
130-	10/0 ha	777.					Archive grat & moisture for @ 130
_	Lexan Liners 1043 ho	sec.		i .		0-9570), sand (5-10%) ist, well sorted -	mojsture by @ 137.5
-	- SSH 53 Lexan	100%.		Plio-Pleistocend?		,	
135—	moust and the	1314 hrs					5x @ 1351
-	Tux lines	1350					
-	#55 Lex line	100%					5x @ 137.5'
140-	moist areneve	1429 CHOS			.,		Su @ 140'
-	lex liner moist	rec					
-	- HS7 lex lue	10%		144.5 -150.5 12	1:1	and the second	5x@142.5'
145-	archiv	1550	- A	grey, 90% grave	•	e, 5 YR W/2 pinkish	St Q 145'
	_	er .	#	Jupio on cobble,		send trailt. dry	end split spoon
	_ #50 c	7 51186	挺	4 - 19 F - 19 - F		7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	
Report	ed By: 🎝	MFaur	rote		Revie	ewed By: DCWeeke	\$
Title:	500109	všt.			Title:	Geologist	
Signati	ure:	Jaure	E)	Date: 08/15/01	Signa	ature: TCaleshes	Date:/0/23/01

			ВС	REHOLE LOG		Page 6 of 8
Well ID:	C 339	3	Well N	ame: 299-WA-44	Location: E. of 241-U	
Project:		RCRA			Reference Measuring Point:	
		mple		Sample Desc	cription	Comments:
Depth (Ft.)	Type No.	Blows Recovery	Graphic Log	Group Name, Grain Size Distribution Moisture Content, Sorting, Angular Size, Reaction	rity, Mineralogy, Max Particle	Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
150-	nrchive	MA	3 7.6	150.5-155' slightly s	silty Gravelly Sanda) as - Angold contact
-		-	09800 UN 8 62	Sand 70% gravel 2	0-25,5,175-10%	archive @ 150'
-			000	Sand 40% fn-vfn,	. 40%. cse. Gravel	
	市	†	20 B	51. VC prb, 10% csep	cb, 70% med prb	
,-]	200	15%, An-van peb. 10)		
เธร —	Archive	1	8000	dry, poorly sirted,	sond sa peb! SA-	
-	1		0000	SR, Strong MA HU	· COATT has	(100 p. p. 0 155)
			00000	Grave 60% 20%	ay GDAVEZ (msg	Aranveelos
_	_		88 dan	Grave : 50% mad 50%	· -	
160'-	Archive	1	2000	van. 104R 5/2 (gran	ush bon), wex-med	archive @ 160'
	-]	80 200	Sorted, Gravel-A	strong own HEL.	
-	-		3000	Basait-60-70%,		
-	-\		7,720	(10% 9+2, 10% feldsp	ar 20% other)	
,-	-]	938			
165'-	- Archive		9806			archive @165
.	-		00 30			
-	7		0.50	ş		
•	7		8 22			
المعالمة المعالمة	<u></u>	4	8-00			archive @ 1701
170'-	- archiv	닉	2000			armie e i to
	_		200			
	_		200	5		
	_					epdoi
175 -	- Archiv		3232	20		archive @ 1751
	-			<u> </u>		
	-		ā.	<u>*</u>		· ·
	-			8		
	_	$\frac{1}{2}$	(88)		2011	
<u> </u>	ted By:	^ Tric			wed By: DCWeekes	<u> </u>
Title:		ologis		Title:	- b	Detect to to
Signa	ure:	-41i	ee	Date: 8/14/01 Signa	iture: / AC MORNES	Date: / 0/23 / 05

			В	OREHOLE LOG		Page <u>7</u> of <u>w</u> Date: <u>8/20/0)</u>
Well ID: (23393		Well N	ame: 299-W19-44	Location: E of 241-U	
Project:		RCRA	Drilli	m	Reference Measuring Point:	
		nple	<i>PI</i> 11.11	Sample Desc	1	Comments:
Depth (Ft.)	Type No.	Blows Recovery	Graphic Log	Group Name, Grain Size Distribution Moisture Content, Sorting, Angular Size, Reactio	Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level	
190'	Archive	414	08 6 2			Anhive @ 180 bgs
- - -	* T					
185'—	Archive					Archive 185 bgs
_						8/21/01
-						188-drum cutturgs
190'-	Archive					Archine B. 1901 bys
-	-					8/22/01
-				195- 40% med pebb	les, Lor. Vfn-fn.;	Archive @ 195
ms'—	- Archive			Basset 55%, Felds	pax 15%, 9 t2 15%; brough gray)(wet)	
	-					8[23]01
2001_	- Archive		8 30 14 30			Archive @ 200'
205'-	Avoni	<u>/</u>		1 m 2 m 2 m 2 m 2 m 2 m 2 m 2 m 2 m 2 m		Archive @ 505
	_		900			
Repor	ted By: (Trice	سا ن دارداد اه ا	Revie	wed By: DCWeeke	2
Title:	i	logist		Title:	Geologist	
Signa	•	1 X =	0	Date: 8 24 0 \ Signa		2 Date: 1923/01

			В	OREHOLE LO	OG	·	Page F of Lo
Well ID:	0339	13	Well N	ame: 299. W19	_ 44	Location: ESP 241-	d Took Form
Project:		RCRA				Reference Measuring Point	Ground Sun Cong
		mple		1	Sample Desc		Comments:
Depth (Ft.)	Type No.	Blows Recovery	Graphic Log	Group Name, Grain S Moisture Content, Sor	ize Distribution	on, Soil Classification, Color, rity, Mineralogy, Max Particle	Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
210-	HT	MIA	æ₀_ ÷	210 5 111	u Sandy, I	Gravel (MSG). Gravel	Grab archive Quo
-			** **********************************	55 10 (assumpt	: nn) due	to Hand tool	Oriller states he's
-) 25"10, 511t 2010.	in highly comented
-	1 1					salt. 40°10 gtz (other)	
-						t felsic rich.	
25-	Archive	4	PETO	104RG12 (1ight	promish 6	nay) wit sample. no	80.5.08120101
	1		FO 3	orn HCI (dry 50	imple)	•	Grab archive DZB
-	1		0000				Kos obleator
-	-		1000	·			
-	1],	1 1	0.0				
220-	Archive	1	3.5				Grab Anchive @ 220/
-	-} [0.05			·	4
-	-						
-	-						
-	-		0.00	225 5117 Sand	4 Gravel (ms6) same as above	225 archive sample
225—	- Andire	4	5.5		<u> </u>		taken.
-	-		2.0.0				CO (3 erm) present
-	-		205	232 sitty sandy	gravel (nsg) grave) 60%	
-	-	1	E X	max size sem	oebbles,	sand vf-cs+, porty	split spaan sample
-	-		53.5	Sorted. silt 1	50. 6 ra	vel SR-SA, well sorted.	
230-	- <u>Pochi</u>		25.25				Grab Archive Sample 200
	_		2.20	233 - 234.6 0	betreemed	Sandy Slity Grave	eo (e.m.ck)
	_	14	_5°5			ic, lok sand, cla	1 1
	_	5 poor)	0-6	77 T		SR. mod serted.	501'T 50000 232.0'-
-	_	90%		1		orted 15% Fine publ	
235 -	- Archin		85.5	50% med pelat		cse pebbles, 20/05m	1 , 1
	_[]	1	99.0	?님	•	plasticity, 60°10	-
	_		SA.	Cobbles. Cla	`	,	
			25	basate, 40 /a	7	***	
			00	(inain); Gle	4		
Report	ted By: -		1:00	Piltor 414 Pale		wed By: Wheke	الــــــــــــــــــــــــــــــــــــ
		Marron	e ma	rt nez		2 () (٠
	معملمها			Date: 1		Geologist	Date: 10/23/01
Signat	nte: CP	aplane.	work	Date: 08/2	Signa Signa	wie. Menses	· Dato. 1425/01

			ВС	RE	HOLE LO	G		Page <u>Q</u> of <u>VO</u> Date: 08 La8io1
Well ID:	<u> </u>	3	Well N	ame: 🔀	19-1019-44		Location:	11-4 Tank Farm (200W
Project:		LCRA E			14-101-1-31		Reference Measuring Po	int: Ground surface.
	1	nple			Sa	mple Desc		Comments:
Depth (Ft.)	Type No.	Blows Recovery	Graphic Log	Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCI				Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
—0بح	H T	NIA	7. 7. 6. 6. 7. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6.	23 3 -	234.5 (CO	no.) 5	x 811 white;	Grab Anhive@ 740
-			= 2 B	6 ley)	8 white	ISYR	513 reddish bro	ouan :
-	-		I 7 . 7 . ~	•			prown. Slight +	7 1
_					HCI. Fe			
		1 1	S. C.					,
245 -	A rest ve		525 29-07	⊇3 4 <i>5</i>	<u></u>	5:11 3	sandy GRAVEL (ms)	6) 6 max Archive@245
-	-	1) ormlier, co
-	-		0.6-	40°/0	gravel, zi	0 10 Sar	nd, 20% sitt. San	d K detectable
-	-\		100 E.O.	m-c	se, mod so	rted SR-	·sa, 40% bosatc,	(A.m. ck)
-	- .		\mathcal{O} or \mathfrak{s}	40%	acclother)	<u> </u>	Atz Cother) 104861	2
250-	- Archiv	-	10		t brownish g		1	Grab Archive@ 258
-			200	Gra	vel = max	size s	in pelbles, mod-son	\$ed
~CC	- Archin	<u>.</u>	1.70	• 1			15: IT as above.	Grab Anchive 6 266
			0000	250	<u>و ۱۹۳۵ کې د ۲۰</u>	<u>r >a no</u>	13.11 13 4000.	OUMILEL <
	⁻	1	200	 	<u> </u>	,		
	_		0.5	267.	<u>5 - 269.5</u> •	<u>ceme</u>	nted silty sandy q	mud detect. CO = 233
							d, 25% silt. San	
_ Osc _	חרטנים –		変 り	' 1			el poorly sorted,	Grab Archive@ 260'
	_ i	1					5,20% med, 40°	
	_						es. Clay present -	
\ \ .	_		50%	Ä		0	Hel Colors.	
			\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	hian		. Ho car	Lis avore les	
		_	800	1 10 A	eule (gra	4 mair		1 5 1 2 1 2 5 1 1 5
– جھر	-Anhiv	-	0.0	2 125.54	pale brow	m; 10 x	e 412 dark grayis	
	-		300) pcor	en; 2.5 YR	. 713 \	nght reddish brow	10
	-	SPILE	- <u> </u>	<u> </u>	18712 pa	Je redi	2.5 4 713 pale 4	11
	-	3000n	0 01-	aley.	8/17 whit	e. 70 C	o basalt, 3010 fe	elsics (A.m. ck)
			117717	4 Fe	staining.	Ja. 1.	wood Day Day C. L. L.	A, B, & @ Lackgroun
		harten	6 Wort	mez.	·		wed By: DCUkek	ெ
	seolog				T	Title:	Geologist	1
Signat	ture: 🗘	arleni	Mast	حو	Date: 08 / 28	Non Signa	nure: / NC Appende	Date: 19/23/01

			ВС	REH	OLE LOG			Page <u>10</u> Date: pq) of 10
Well ID: و ع ع م الاوال Name: ع م م الاوال Location: ومود م عسا									
		RCRA 1			1-W14-40		Reference Measuring Point:		
		nple	31 4 12(1)	4	Sampl		Comments:		
Depth (Ft.)	Type No.	Blows Recovery	Graphic Log		me, Grain Size Di Content, Sorting, A Size, F	Depth Method Sampli	of Casing, Drilling Method of Driving ing Tool, Sampler e, Water Level		
בסרב.	Archive	מוה		269.5			andy GRAVEL (MSG)		A rohlue @ 270
_	1	1	32,020		•		d on hard tool). 65% silt. Sand uf-ree		
_				•			o med. 45 10 cse.		
_ ২>১১ —				60°/2 1	pasalt 40		Laics WYR. 612.	7 5	> = 272' bqs
				וש כיי	Hel.				
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-	-						3,41,40,40	Ī	
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.	_								· · · · · · · · · · · · · · · · · · ·
Report	ed By:		<u></u>	<u>.,</u>		Revie	wed By: DC Weeke		
Title:	ور <u>حهره</u>	harler c:st	- IM OZ	times		Title:	Gologist		
Signati	TLE: OV	arlene	marti	787.	Date: তথ্যসূত্য	Signat			Date: 10/23/01

					Start Date: 0810	- (0)	
WELL CONST	FRUCTION	SUM	MAR		Finish Date: \$\big _33/		
				START CARD	Page 1 0		
pecification No.: V 0004 SP-R	lev. No.; O			Vell Name: ع م م ـ س رم ـ د خ	Temp. Well No.:		
CNs: NA				Approximate Location: East			
roject: CYOI RCRA 1				Other Companies: CHI	510C OT -	41.44	
rilling Company: Resonant	3 C. Hind		- 	Geologist(s): C. Martinez	Ctrice, 6.7	homas.	
riller. M: Ke Gomez	Sonic Inc.			o.c. weekes.	•		
TEMPORARY CASI	NG AND DELLA DEE	- 68884	501578675	DRILLING METH	DOWNER DIAMETE	Sint list list	
*Size/Grade/Lbs. Per Ft.		Shoe O.I	Section 1	Salar Sa	Diameter From	to	
	Interval			Auger:			′
carbon Steel (FJ)	المتملهاه - 20	10.41		Cable Tool: X 103/4 0(D	Diameter From		30
1034" 110"				Air Rotary: X Tricone Bit	Diameter From 30		<u>le6.1</u>
		 		A.R. w/Sonic:	Diameter From	to _	
					Diameter From	to .	
					Diameter From	to .	
Indicate Welded (W) - Flush Joir	nt (FJ) Coupled (C) (3. Thread I	Design	<u> </u>	Diameter From	<u> </u>	
					· · · · · · · · · · · · · · · · · · ·		
							
	- 			Drilling Fluid: A: r			
	Hole Dia @ TD: \	<u>~ "</u>		Total Amt. Of Water Added During			
Well Straightness Test Results: D	one w1 20.4,	8/200	Tool	Static Water Level: 224.4	Date: 8/24/	01	
Passed 08/15/01		∰ GEO	PHYSIC#	AL LOGGING A LEMPERA DE LE	大学 对报告 。	想经	
Sondes (type)	Interval	Da	te	Sondes (type)	Interval	Dat	e
Spectral Gamma	0'-115'	8/15/	01				
Spectral Gamma	114'-266'	8/16	101		\ <u></u> •		
Neutron moisture	0'-225'	-77	101			1	
				ED WELL	与美国的基本企业		
Size/Wt./Material	Depth	Thread	Slot Size	Туре	Interval Annual SeaVFliter Pack	Volume	Mesh Size
4 20 85 Sump (3046)	25903-261.13	F480	ΔIB	Colorado silica 5 and (50 bo	213.4 - 266.1	2003	10.2
4"ID SS 3046 Screen	224,12 - 259.05	, LI	0.020	1	207.3 - 213.4	5 buck	3,511
4 TO 55304L casing	+ 211 - D24.12	. u	NIB	Bentonite Crumbles (50#) <u>9.5′-207.3′</u>	146 bag	NA.
4	-			Portland coment (94#)	0'-95'	4 bags	nia
		1					
7.34 (2.75 P. 17 E. 2.75 P.		3.50	OTHER A	CTIVITIES		建 缩6.3	
Aquifer Test: Well Devel	ppment	Date: 8	1461	Well Abandoned:	Yes: No:	Date:	
Description: Pumped bottom sec				Description:			
pump intokeset at 257.5							
17.33 drywdown. Rung raised				dayh			
1733 GIAMONN . TUIN 147XA	10 636,3 695 9Md			ISI'. RVEY DATA	V. 57/-5507	# # \$ \$ \$ \$ \$ \$	
Date:			<u>nereje</u>	Protective Casing Elevation:		(FF IEm) <u>tela i</u>	Carried Control
	nator:				······································		
Washington State Plane Coordin	iaica.	19844444 7	CMMFN	Brass Cap Elevation:		9682E75	
Val. poles : : : : :	1 COLUMN TO THE TAXABLE PROPERTY.	<u>.</u> 55≥	Contract of the second	Et3: bent pellets. 5 bu	40°	inc = 3.1	۴t³۰
Vol. Calco: Silica san	6002 7 00424 08	35 bag=	<u>- 7,08</u>	oft pertiand coments	baas * 1.285	ft3/bag=	5,14
Reported By:	•	my-	.~ 2.6(Reviewed By: Wuket	PC		
Reported By: Chartene	Martinez.	There	- 1 1		ــــــــــــــــــــــــــــــــــــــ	Date:/	V2 KI
Title: Gcologist		Date: \	<u>olz310</u>	4.80	hes	7	ict
Signature: Charles W	satterey			Signature: XC (1801			

) Darma a	CLIBARA A DV CL				Page 1 of 2	
	SUMMARY SH				Date: 08[15]01	
Well ID: c3394		Well Name: 299-619-45				
Location: East Side of 241-4				CRA Orillin		
	Date: os (21/01	 	By: 1) C C	weekes .	Date: 9/20/01	
Signature: Charles marting	-	Signature:	MC	Weekes		
CONSTRUCTION DATA	<u> </u>	Depth in	C	SEOLOGIC/HYDRO	DLOGIC DATA	
Description	Diagram	Feet	Graphic Log	Litholog	ic Description	
"-dia. protective easing set. 1.0 above 4 stainless casing 4 "TO SSBOUL casing: +2.11 > 224.12' Pertiand Cement Grout: 0' > 9.5' Bentonite Crumbles: 9.5' > 207.2' 38" Bentonite Pollets:		40	(a) (b) (c) (c) (c) (c) (c) (c) (c) (c) (c) (c	45-30 5 9 10 4 10 5 1 15 10 5 1 15 10 5 1 15 10 5 1 15 10 5 1 15 10 5 1 15 10 5 1 15 10 5 1 15 10 5 1	Sandy Gravel (ms6) (m) Sandy Gravel (ms6) A Sandy Gravel (ms6) And (S) A Cavelly Sand (GS) And (S) And (S) And (S)	
4" ID 55304 L 0.020-in. 51DT CONT. with-wrap wellscreen: 224.12 > 259.03' 10-20 mean silica sand: 213.4' > 266.1' 4" ID 55304 Tailpipe (54mp): 259.03' > 261.13' All temporary casing removed. Qui depths are in feet below ground surface.		120-		139.0' - 139.0' 139.0' - 145.0' 139.0' - 145.0' 148.0' - 145.0'	ity Sand (ms) Sand (s) Sandy Sitt (sm) Calcrete 'sitty Sandy Gravel(m) Gravel (s) cravel (g) Ity Sond (ms) Gravel (g) to sittlson Sandy Gravel (sg)	

WELL SUMMARY SHEET Date: 08 15 01 Well ID:						Page <u>2</u> of <u>2</u>		
Description Diagram Project C 401 R CRA D r: Ning		L SUMMARY SI						
Prepared By: Charles Martines Signature: Si			Well Name: 299- w19-45					
Signature: CONSTRUCTION DATA Description Diagram Depth in Feet Graphic Lithologic Description 240 - 251 - 21010 250 - 21010 TO = 24411 base straft con 8/24/01 MW		arm	l ·					
Description Diagram Diagram Depth in Feet Graphic Lithologic Description 240 240 240 240 240 240 240 24		Date: 0812/10/	Reviewed	ву: <i>DC0</i>	veekes	Date: 9/20/01		
Description Diagram Depth in Feet Graphic Lithologic Description 140 — 10 \ \(\) \(\	Signature: charles martinez		Signature:		Weekes			
Diagram Feet Craphic Lithologic Description	CONSTRUCTION DAT	[A	Denth in		ROLOGIC DATA			
300 — 300 — 300 Salo 1 240 — 250 Salo 1 Salo 1 250 — 225 - 210 to TO = 200 1 Salo 1 T	Description	Diagram		Log	Lithologic Description			
and depths are in feet below					- (pa-t of p 225 ~ 2	noty commend to lasto previous description		

EDC Particular	22102	WELLBOOK	151	DATA RE		Wagner, P.L.S.
ERC Project:	22192			: Rogers Sui		
	11.446					
Date Request	ed: 11/19	/01		Requesto	r:	
Date of Surve	ey: 12/05/	01		Surveyor	: Rogers Sur	veying, Inc.
ERC Point of Contact: Mr. Robert Bone					o. Point of Co	
Description o	f Work:			+	al Datum: N	
Civit survevin	a för eleve	n groundwater we	11e	Vertical I	Datum: NAV	D88
in 200W & 20		i groundwater we	113	Units: M	letric	
				Hanford	Area Designa	ition: 200W
Coordinate S	ystem: Wa	ashington State Pl	ane (L Coordinates	(South Zone)	· · · · · · · · · · · · · · · · · · ·
Horizontal C	<u> </u>				<u> </u>	
HSWB-037 &						
Vertical Cont 2W-43 & HSV		nents:				
Well Name	Well ID	Easting	No	rthing	Elevation	
299-W19-45	C3394	566897.65	1	35087.65		Center of Casing
					206.413	"X" on Rim
······································		566897.64	1	35087.88	205.661	Brass Cap
Notes:		· · · · · · · · · · · · · · · · · · ·	<u> </u>			
Surveyor Sta	tement:		·	Certificat	tion Seal	
<u> </u>		ssional land survey	or			
registered in th	e state of W	ashington (Registra	ition			
No. 30440), he	reby certify	that this report is b	ased			
on a field surve	y performed	l in December, 200	1			
under my direc	t supervision	n and that the data		I		
u	•			1		

BHI-EE-202 (09/98)

,			D.C	ADELIOI E LOC		Page 1 of 9
				PREHOLE LOG	•	Date: 08/06/01
	<u> </u>		Well Na	ame: 299-1019-45	Location: Easz Side	
Project:	101	RCRA	Onillin	<u>و</u>	Reference Measuring Point:	I
	Sar	nple		Sample Desc	ription	Comments:
Depth (Ft.)	Type No.	Blows Recovery	Graphic Log	Group Name, Grain Size Distribution Moisture Content, Sorting, Angulari Size, Reaction	ity, Mineralogy, Max Particle	Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
0 -	Cuble	คเก	750 4 5033	0' > 45' Silty Sandy	(msg) GRAVEL 10 10 site,	Cable Tool, Drive Barrel
-	1007	ļ. ₁	700	55 10 Sand, 35 10 Grave	el. Sand uf-cse	7/2"00/472" ID
-	-		20	45% uf-4, 30% med, 25%	•	X. B. &@ background
-				Gravel, poorly sorted max s	ize a gomm. No rxn Hel	
5 -			503	45 - Sondy SITE (SM) 40 "(1	5and, 60/05,16.	And in some do O.S.
3 -	- Archive	1		[1]		Archive Sample (a) S
_	_		4077	med. 10 10 ese. Strong rx		16-7 no recovery
-	-			8.0'- 105' 5:1+4 Sandy 6	ravel (ms6) 75 to grave	1 1
.	_		200° 001°	200 10 sand 5 10 silt.	Sand SR-SA, well	9' cobble ~ usmm
10 -	- Acchive	‡	0.03	sorted, 50 cse, 25 % med	1, 70° b uf-f. Grave)	Archive sample@ 10.0'
	-			51-54, med sorted. 60%.	am pehbles, 25 10 med	9, B, 8 @ background
'	-			pebbles, 15% lg. pebbles		
	-		20.37	10YR WI. Visible colcered		
	-	_		exa HCI. 70 10 gtz lother		Grab Archive @15
15 -	U ccy; n	re	800	10.5 -11.0 5:1t (m), 5:1t		M, B, N@ background
				5°10 sandlaranel interba	and the second s	1,0,000
			00 O	5 11.0 - 13.0 5.174 Sand	' '	
	_		000	5:1+; 85 % sand. Sand		·
20 -	- Acchiv		2005	= = = = = = = = = = = = = = = = = = =		Archive sample @ 20'
	- 1			Brodules (IDYR 5D) grav		& B. & @background
	-		0,0	6) HC1. 75'10 gt 2 (other)		<u> </u>
	-	1		2) 13.0 - 20.0 silty :	sandy gravel (mag)	@ 23' 19 cobble ~6"
	-		000	50°10 sand, 40°10 9 may	el 10% silt. Sand uf.	
25	- Aceri	¥e.	92\0 2 0	C ese poorly sorted SR-SA	10 % cse, 30 10 med,	Archive sample @ 25'
	-		90	6 40 % Uf-P. Gravel mod	sorted 80 10 sm pebbl	cs of, A, Y @ background
	-			2	4 90ma . 104R 5/2. Str	,
	-		0.0	in my Hor. 25 to get el	(other) 25 6 hasa R	l. '
Repr	orted By:	<u> </u>	<u> ::0::0</u>	Revie	ewed By: Weeke	(Pinkish gray) conting.
Title:	Garle	harvene	mart	Title:		
Sign	Geolog	orlers.	M		0805///2	2 Date: /0/24/01
		7274 -71V-7	1,104715	2 2000		7 /

			ВС	REH	IOLE	LOG				Page <u>2</u> of <u>9</u> Date: <u>08 08 01</u>
Well ID:	C339		Well N	ame: 🤰	99-601	. ૧-૫૬		Location: ర _{్షక} ా	n C 201	•
Project:							Reference Measuring Point			Ground Surface.
							e Desc	ription		Comments:
Depth (Ft.)	Type No.	Blows Recovery	Graphic Log				Angular	on, Soil Classification ity, Mineralogy, Ma n to HCl		Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
30-	AIR	UIB	0.01 0.10 0.10	20.0′ -	· 26.5	5and	<u>4 600</u>	uel (sq) 30%	sand,	Rir Rotary Tri-cone bit.
_			9.5.5 9.6.6			•		Sand UF-C		Archive Sample @ 30
			%					10 cse, grav		7, -c, /3 @ background
35 —	Archive						-	strong run Ho		sm cobbles ~65mm
-	-		202	28.5'-	- 30 o'	sliahtlu	sitte	, sandy grave	. 5: 15	Grab Archive @ 35'
-	-			8/0,5	ond 55	10, 90	avel	y sandy grave 35%. Sand f	ب دع-د	LEC. organice Eddoot.
-	-		7:10:					o med, Gravel		
-	-		@ 0 =	5m,	20 % me	3 5°16	C5-C	.SR. LOYRU	2 light	
40 -	- Archive	1	0.0	prown	ish qray	. Strong	T LXD	Hei max 3:22	< 63 mg	Archive Sample D40
-	-		00	30.0 -	- 52.0	5:11	sand	y gravel (msg)	10°(0	
-	-		250	<u>sile.,</u>	35 10 5	and, s	≤ °/0	gravel. Sand	<u> </u>	
-	-		5.0.5					cse, gravel 8		
-	-		200	5m, 1	5 10 m	+1.5°/	cse	max Size ~	83 mm	
45 -	- Archive		1			4		•	of tran Ho	Archive sample @45
-	-		Sog.	75°/0	gteloth	ner) 25	10 k	pasalt		
-	-		007							
.	-		0.5							
•	-		0.0							Grab sample @ 50'
50 -	-papira	1								
	-		6	i						
	- ACLLY	1	5.50	52.0	·65' 50	and (5)	- ८	10 gravel Sa	نم	Grab Ambive Q 52
	-			VF-W	~ 80°/	0 uf -	6 , 2	0% med. tra	به جعد ب	
	-			well	sorted.	se K	YRS	12, grayish be	مال معناه	
55 -	- Barriro	리	<i>v</i> .∴c	لحمما	HCI	70°10	9C 2	(other) 30%	basalt	Grab Archive @ 55
ļ	-		ಿ ರ	55'-	64'	Grav	elly s	and (65) gra	uel 15°/	<u> </u>
	-		0.0	Sand	8500	<u> </u>	_\v°	10f. 30°10 med	രവ,	
	-		0 % 0	<u> </u>	<u> ۷ نه فی ۱</u>	R-SA ~	n a) 5 0	Hed. Gravel m	व्य क्वपंत	1.
.	<u> </u>		15.		ehbles. I			Ay No ran HC	1.75%	gter 25 6 basalt
		harlen.	Mart	nez			Reviev		weeks	25
	Geolog						Title:	Geologis?		
Signat	ure: 🕓	arlens V	natura		Date: 68	lo š lo,	Signat	ure: <i>NCAfe</i>	YES	Date: 10/24/01
DI II EE	400 (40)07		4	7						• •

			ВС	REHOLE LOG		Page <u>3</u> of <u>9</u> Date: 8/9/0/
Well ID:	(33	394	Well Na	ame: 299-W19-45	Location: East of Z	
Project;			4 Drill		Reference Measuring Point:	
		nple		Sample Des		Comments:
Depth (Ft.)			Graphic Log	Group Name, Grain Size Distributi Moisture Content, Sorting, Angula Size, Reactio	rity, Mineralogy, Max Particle	Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
<u>د</u> ه ص	ATR	NA		60 Gravelly sand (gs) sam	e description as 56'	6 rab samph @ 60
_	.	. 1		75% qt=(other) 25"10 bo	salt	Airrotory w/ tricons bit.
-						End shift 8/8/61 @ 62'.
_						@ 62'.
	1			64->69' SAND(S)): 5% grave (, 95%	,
65 -	Archive	1		mostly ve sand to sit	104 R 6/1 gray (dry)	Grab sample @ 65'
_				mostly ve sand, to sift dry, moderately sorted,	A-5A, 30% bas,	•
-	.	1 1		20% other (gtz), mps 4	mm, modern to HCP	
-				7 7		
_	.			69'->90'		
70 —	Archive			5AND(s): <52 gm	avel, 95% sand (mostly	Grab sample@70
-				fom) to silt, to	mica, 104R6/1 gray	,
-				f-m), tr silt, tr	ed, A-SA, 30% bes,	
-	-			70% o Her (mostly 9tz), m	ps 5 mm, slight to	
-	-			mod own to HCE	, , , , , , , , , , , , , , , , , , , ,	
75 —	- Archive	1				Grab sample@75'
.	-	7	1			
-	_	1 1				
-	_					
.	_					
80 -	- Archiv	-		: higher percentage of vf	-f sand @ 80'	Grab sample 80'
ļ~ .		1		1119/10 1000114/1	1 24 20 0	
	_			:		
	_			•		
	_					
	_ _	-				Grab sample @ 85'
26 –	- Archive	식	:			Star Campie so
			· ::.			·
	_			•		
1						
Report	ed Bv·	7/1/	kekes	Revie	wed By: DCL/CeCe	5(1 1/25V-
	Geolg		ندانون	Title:		Geologia
Signat	1	77.1	20 60 1	1- 4// 1-	190	A Date: Intrafor
Oignat	<u> </u>	yu	urek.	Date: 8/9/0/ Signa	Now while	(Olas Juliule)
BHI-EE-	183 (12/97)			, ,	8

			ВС	RE	HOLE LOG			Page _/ Date: 8	
Well ID:	C3	394	Well Na	ame:	299-W19-4	5	Location: Egst of 2	41-6	Tank Farm
Project:		RCRI	4 Dri				Reference Measuring Point:	Grov	nd surface
	l	nple			Sample	Desc	ription	(comments:
Depth (Ft.)	Type No.	Blows Recovery	Graphic Log	Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl			Method Sampl	of Casing, Drilling Method of Driving ing Tool, Sampler e, Water Level	
90-	Archive	N/A		90'	91' SAND(S)	: 50	ame@5 64-69'	90 91	ab sample
-	arctive	1		911.	->95' SAND/S): /	00% A-food mica	91 3	ab sample
-				Co	mmon, 90% qtz I sorted, strong r	10%	bus, 10/R6/1 gray (dry	Air bit	ntary w/tricon
95-	9 rchive	} }		95	-98' SAND(S):/	100% sand (mostly	95'91	al sample
/3-	- Grenne	1							
_	_			80	2 9tz, 20% 695	tr,	fl gray(dry), moist, nica, mps 4mm, nod		
_	-\		- :		n to HCl			ļ	
-	- }			98	3'->1/3' SAND(<u>s):</u>	100% sand primarily	1	
100-	-grclin			\vf	-f, 10YR 6/2	<u>- /i</u>	ht trownish gray (dry)	100'	arab Sampk
	-\			: mo	ist, strong ryn	10	HCR, A-SA, 90%		
.	-			9/2	, 1090 bas, well.	sorte	<u>d</u>	-	
1	-	1 1		:	1			-	
	-	4		_				1051	orab sample
105-	-grchiv	탁		:}-				105	A40 Stripic
	-	1		:-					
		1 1		:			<u> </u>		
//0-	-archi							110%	arab sample
1/10	_ 17								
	_			- 1/.	3-118' 5ilty	SAI	ND (m5): 20-30%	<u> </u>	
	_	1 1		1			nostly of f), loye	_	
115	-archi	<u>a</u>		6			my (dry), moist, well	115	grab sample
	_	1 1		50			strong rxn to HCL		
	_			• •	ica common,				
	-	, ,		<u>: </u> _					
	_ _\	<u>′ </u>				т			<u> </u>
Repo	orted By:	DCW	eckes			+	ewed By: Chro Ma	46m	<u> </u>
Title:	<u> </u>	o logis	<u> </u>		-1	Title	9000		Date: 10/24/01
Sign	ature:	NC U	selfi	0	Date: 8/9/0/	Sigr	nature 1		Date. Volv 1/O

			ВС)RI	EHOLE LOG			Page <u>5</u> of <u>9</u> Date: 8/9/0/
Well ID:	C3:	394			299-W19-45		Location: Fast of 24	
Project:		I RCR					Reference Measuring Point:	, ^
		nple	<i>بالا ا</i> را	''('	Sample	Desc		Comments:
Depth (Ft.)	Type No.	Graphic Log	Groi Mois	up Name, Grain Size Dis sture Content, Sorting, A Size, Re	ngular	on, Soil Classification, Color, ity, Mineralogy, Max Particle n to HCl	Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level	
120-	arclive	NA		1/2	8'→129' SAND	(5)	: 95-100% sand	120' grab sample
	AR	1		Gr	inapily vf-m), y	pto	525iH, 10YR6/2	Air rotary W/tricone
_	}			lig	aht brownish gray (dry)	moist, mica common,	bit
_				w	ell sorted, quart	zric	h, strong rxn to HC	
-								
125-	grchive	1		ļ				125 grab sample.
-								,
_	-			<u> </u>				
-	-							:
-]		120	7->133' SAND	5(5,): 90-952 59ndf-vt	
130-	grative]	1::-	5	-10% silt, 10YR 6/	/2 /i	ght brownish graydry	130 grab sample
-	-			m	oist, mica commo	n, h	jell sorted, gtzrich	
-	-				Frong rxn to HCl		6 \ \	
-	-		1.		33'->137' 5andy			
-	-	_			90% sand (vt)	non	plastic, 104R6/2	125 mm/ som//
135-	-gractive	4	1.	14	ight brownish gray	(dry	moist mica common,	135 grab sample.
-	-				vellsorted, 9tz nich			
-	1 1]]	4	_	37'→139' Calca			130'/
-	- archi	1					pale prown (dry), moist	138 grab samples
-		_	0:0	47	trong rxn +HC	<u>(</u>) 7	round up	1160'and sample
140-	- relie	<u> </u>	0.0	3 13	77-7 145' 31/7	7 0.0	andy GRAVELLIMSG)	110 9196 11191
•	-) /		1.0.0	1			Sand 102 sitt, 10/R	7
'	_	1 1	0.0	. 1 .	70-80% bas, 20-30	argy.	(dry), moist, overall the including some	
	-		0.0		1.01	Angui	<i>,</i>	
1,,,,		_			Strong rxn to HCL	7	ar, mps 25 mm,	145 grab sonde
1795	-19724),	곅	0000		11-10-	4VE	L(G): 80-90% grave	1 1 1 1 1 1 1 1 1 1 1 1 1
			6.0		10 769 611 1	· 1	color as above	· · · · · · · · · · · · · · · · · · ·
			000	ㅁ	0118	9101	en little caliede,	
	_ \	V	0	-	game 6 of bas 191.	2, YS 19 1%	. 1100	
Report	ted By:	7/1	veek			/	wed By: Chris Inite	W
Title:	Gen	0/091	, ,			Title:	(900)01151	
Signat		Cake	Des		Date: 8/9/01	Signal		Date:[0/24/0]

			В	OREHOLE LOG		Page 6 of 9 Date: 8/9/01
Well ID:	C33	94	Well N	ame: 299-W19-45	Location: East of ZS	4-U Tank Farm
Project:	CYO	1 PC		prilling	Reference Measuring Point	1
		nple		Sample Des		Comments:
Depth (Ft.)	Type No.	Blows Recovery	Graphic Log	Group Name, Grain Size Distribu Moisture Content, Sorting, Angul Size, Reacti	arity, Mineralogy, Max Particle	Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
150-	grafine AR	NA	0.0	148' > 154 Gravell	4/5AND(95): 20%	150 grab sample
_	AR	1	6	gravel, 502 sand, 3	020 silt, 5/5/2	
_	{		0.0	plive gray (dry), mois		
-			Ó	basattoverale, stro.		
_			0.0	154'-> 103' GRAV	(EL(G): 80-90%	Harder drilling
155-	archive]]		Gravel, 10-20% silt	459nd, 575/2	@15x'
-		1 [20000	olive gray (dry), dry	, 60% bas, 40%	Grab sample D 155
-		\	2008	Other including rusty 9	varteq volcanics,	
-	\cdot			strong rentotte		- 101 Plate:
-			200 p	/		Endas slift 9/9/01,
160-	atchive]	10000	\		
-						
-	1 1			163'-165' Silty SA	ND SANDOBO 90%,	163 grab sample
-	Armin			SH CAS-101, DYR 9/2 Hbrok		
-				165- 202 GRAVI		
165-	archive	7	30000	10% 51/+ sand. 10)		1 0
-	-		2000	70-80% busalt, 20-30% of	ther , angular, no run HCl.	
-	-		3 79 3			
-	- }					
-	-]		<u> </u>		,
170-	anhive	7	0000	170 - Grave 612 prodominantly . Sitt	e increases to medun	170' grab sample.
-	-	1		predominantly. Sen	d increases to 20%.	
-	-	1 1	0000	<u> </u>		
1 .	-		0000	<u> </u>		
1,	-[_]	_	0.88	<u> </u>	= (0):07 (87)	6 .
175-	- archive	4	9800	175'- 511ty san	+ GRAVEL (mista)	115 grab sk.
1 '	-	1 1 .	8393	\$ 80-90% gravet, 10-20	7. Gilt + sand layRuly,	
1	-		<i>43</i>	59 90% has 20 gtz, A-SA	-R, no ten HCl. In-vir	7.
			2733		- 1 - 1	
Report		DOO	10000	30 178 - Gravel Size increa	7 6	1
Title:		hogist	rckes	Title:	^ /	ilw.
Signate		1/1/2/2	chin		ature:	Date: 1 Seuf of
Cignat		case	you		MANY CANADO	

			BC	REHOLE L	റദ		Page
Well ID: 4	1339	. 1		ame: 299-W19-		Location: F of 7/1	1-11 Tankfarm
Project:		4 200	24 5	219 - WIY -	·70	Reference Measuring Poir	
1 103001.	CYO	nple	A Dr	illing	Sample Do		Comments:
Depth (Ft.)	Type No.	Blows Recovery	Graphic Log	Group Name, Grain	Sample Description Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCI		
180-	archive And Abory	N/A	120000 00000 00000 00000 00000			1, 10% fn, 20% cse.	grab lep archive
- 185-	-						grab 185'crine
(D) -	- aronlu						
140-	- arthiu	e					gas 190° archive
195-	- arhi	14		R4- growl had 30%	ble p	red fil-vfn, 20%,	gab 195' archive
	_ _ _			8 8 8			197'-end day 8/10/2 Skurt 5/13/01
206-	-akhi	بع	2000 2000 2000	\$ 700 ¹ -	~~~		grab 200'archive
	-aven ()		0.0	202 26 San 6 40/Sand 6 2 10485/3 (1)	ay EK Di grav aun), 1	AVEL (SE) el. Sund R. Arave moist, 80% besult, 20	grab 202' archise
zo5·	arciv	•	0.000000000000000000000000000000000000	o other fred o no (xn Hz	m mes	pebble - SA-R	grab 205' arthur
Repo	orted By:	CIRI			R	eviewed By: DCUke	tes
Title: Sign	: Goo ature:	109/5	+	Date; 😂	/ / -	itle: Geologist, ignature: NO Yeska	Date: 10/24/01

· · · · · · · · · · · · · · · · · · ·			ВС	OREHOLE LOG		Page <u>8</u> of <u>9</u> Date: 08(13/0)
Well ID:	C33	94	Well N	ame: 299-W19-45	Location: E. of 241	- 1) Tank Farm
Project:	CAG			nilina	Reference Measuring Point:	
		nple		Sample Desc	ription	Comments:
Depth (Ft.)				Group Name, Grain Size Distribution Moisture Content, Sorting, Angular Size, Reaction	Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level	
210-	archive	AL,	2000	210- 275 graves (G)	/	gab 210 archive
-	1 1	<u> </u>	3333	silt + sand. 10YRV/21	(It brish grey)	
-	-	1 1	6938	dry 20% mosalt, 20% of	her, A, norunt(1.	
-	-] }		6000	Predom med pebble	•	
-		1	18000			
215	archix		55888	215 - gravel 90%, sand	1+5,1+10%	mah 25 archive
215	- 1]	25.50	,		
_	_	1 1	2000			
	1	1 1	2001			
-	-1 1	1	1000			
-	<u> </u>]]	0808		100.4	1-222/15
220	- archiv	4	0,288	pd. gravel predon	n use -vose	grab 270 arhuz
-	-		800		<u></u>	
.	-		0000	<u> </u>		#20@ 224 81 bas
.	-\ \	1	0000	ģ		(08/15/01)
		1 V Z	W. 75	SILT GOALL	66	spit your -
225-	- <u>F.K. 29</u>	Split		d 215 - 266 Small Cok	bles 30% CLVCS	2 224-226
	<u> </u>	Spoon	10.00	9 mbbles 10%, 70%	in copples.	archive - 225
	_	71	0.99	60% Gravel 30%	and Trans	
1	_	1 1	02.0	9 10 48 42 (+ brash a	rey) 1 Wet, 70%.	
	_		000	مان (حلام)	A-SR-Ryporch	Edofonft
		_	5.00	2 1101	A COM TRANSFER	013/61
230-	-anhiv	د ا	200	<u>i</u> fu ,		
ļ	-	1 1	80	<u></u>		Grab Archive Q 23)
1	-	1 1				
	-[97.25			
	-			<u> </u>		- 1 225', 1
225	Arel	32		235 - Mostly broken	gravel from granules	grab 235 Archive
	_		公公	to Course publis. Sand	d & Silt present hower	er
	_			Douly in trace Amounts de	us to Adhesion to Chi	7
	_		Qe		w of silt 10 YR 7/4.	
			72	Assumption 15% silt.	25-30% Jand, 55-60% 6	iravel
Reno	rted By:	7 7	, nous	1 61 Pavis	ewed By: DCURER	<u> </u>
Title:		6010a1	LL-/C	Title:	2 1	
		WING!	5' /US	Date: 0/3 0/ Signa	0800/ //	Date: 10/24/01
Sign	ature:	CAN.	S [] [] []	(Comment of the Colonia	The comment	1 10/2//01

			D.C	OREHOLE LOG		Page q of q
					1,	Date: østrylor
	C3392			ame: 299-w19-45	Location: East of 241	
Project:	C401 1	RCRA D	v: 11; wa		Reference Measuring Point	1
	Sar	nple	Ì	Sample Des	scription	Comments:
Depth (Ft.)	Type No.	Blows Recovery	Graphic Log	Group Name, Grain Size Distribut Moisture Content, Sorting, Angula Size, Reaction	arity, Mineralogy, Max Particle	Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
240 —	47 LPC		NIA	241', Return 85%	med - V corres pelloles	Grab Archive 241"
-	Archive			~ 5% SAND. NO C	obles ar Silt in	
-		900		return. Most of the	med- Veares pebbles	
-				are munded BASAH	15%	
			4	245' Return 80 Granul	s to medium pelibles,	
245'-	Anchie			15% SAND & Silt, 5%	6 COAMSE to V. COAMSE	Grab Archive 245
-		800	<u> </u>	pelibles Pelibles are M.		
_		V DE		Sab angular,		
-	-					
-	_					
250_	-Archive			250' Silty Sandy Grave	1: 65-60% Grave.	GATAL Archive 250'
-	-		9 '.	30-25% SAND 5-15% FA	1/4 25% GATE,	
.	-		andle	\$50% M 250% Vf-fine P	relibles. 7kHbles Indiron	refed
-	-			to sub Angular, Sand 36	V.C, 259, C, 20% M	
	-		3	20 vf.f. Basalt 25		
255'-	- Avehive	8.58	3	255 Same As Abo		Grab Archive 255
.	-	200		Content lower &	more Gravel.	
.	_		-4	-		SS-257-259'
	- Split	90 (split spoon	257 Silty Sandy Grand 4	ravel: 5:1t 30%.	
	- Spoor) DIC) speen	Sand 30 10. Gravel 4	o 6. Cemented, non-	
260-	<u>Archive</u>		AIN B			Grab Archive @ 260'
	_	57.00	图	20°10 m - cse. Sub ra		High silt content (slung
	_	96		Gravel 5% sm cobbles	20% med pebbles,	
	_	$Q_{i}\zeta$	<u> </u>	75 0 sm pebbles Poorly	SOTTED SR-SA. 80 10	
	_	1000		felsics, 20% basate. Cal		Grab Archive TD
265-	_		줾 ㅣ	7.5 KR 812 Pinkish wh		= 266.1
	_	20°5	<u> </u>	2.5 Y Ul4 light yelbulsh		<u> </u>
	_			Gleyl 7/564 light gr		TO=266.1
	_			steining.	. 4	
	_			266 Stity Sandy Gr	quel	
Repo	rted By:	Greo 1	Thomas		riewed By: DCWeeks	<u> </u>
Title:	Gide	2157 /	1	ologist Title	: Geologist,	
Signa	- 1/	Wes Ha		marting Date: 08/15/01 Sign	000	Date: 10/24/01
<u> </u>		11		2		

Appendix B

Physical Properties Data

Appendix B

Physical Properties Data

This appendix includes the results of testing for particle size distribution on split spoon samples from the wells 299-W18-40, 299-W19-44, and 299-W19-45. The analyses were done by CH2M HILL Hanford, Inc. using standard sieve techniques.

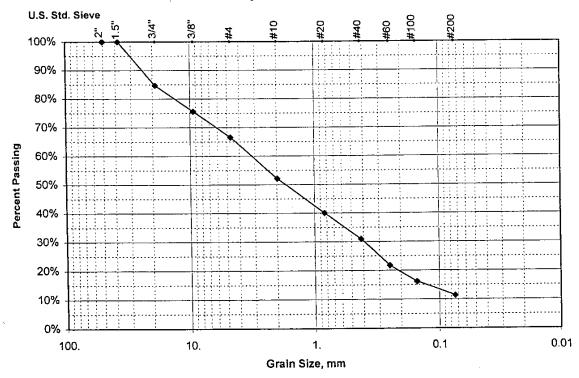
CH2M Hill Hanford, Inc.

SIEVE ANALYSIS

WELL NAME	299-W18-40	DEPTH	220.0'-222.5'	SAMPLE#	W18-40-220.0		C3395
TESTED BY	J.M.Wimett	CONTACT	Dave Weekes	PHONE	372- 0130	DATE	10/16/2001
					9601	ger/	
SAMPLE	SIEVE	CUMULATIVE	% WEIGHT	%	Grain Size	COMMENT	rs
WT (g)	SIZE IN.	WEIGHT(g)	RETAINED	PASSING	(mm)	<u> </u>	
		1		1000	50.00		

SAMPLE	SIEVE	CUMULATIVE	% WEIGHT	%	Grain Size	COMMENTS
WT (g)	SIZE IN.	WEIGHT(g)	RETAINED	PASSING	(mm)	
980.90	2"	0.0	0.0	100.0	50.80	
	1.5"	0.0	0.0	100.0	38.10	
	3/4"	150.2	15.3	84.7	19.05	
	3/8"	239.9	24.5	75.5	9.42	
	#4	328.2	33.5	66.5	4.70	
	#10	469.7	47.9	52.1	1.98	
	#20	588.5	60.0	40.0	0.83	
	#40	677.5	69.1	30.9	0.42	
	#60	767.6	78.3	21.7	0.25	
	#100	822.4	83.8	16.2	0.150	
	#200	869.6	88.7	11.3	0.074	

Sieve Analysis Data for Sample W18-40-220.0



Comments: Silty Sandy Gravel

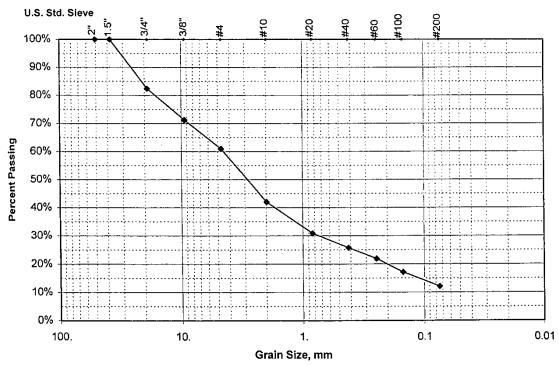
All data are accurately and completely recorded.

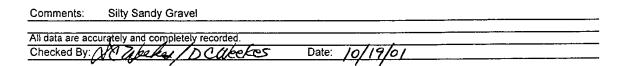
Checked By: // Weekes / DCWeekes Date: /0/19/0/

CH2M Hill Hanford, Inc. SIEVE ANALYSIS

WELL NAME	299-W18-40	DEPTH	250.0'-252.5'	SAMPLE#	W18-40=250.0	WELL ID#	C3395
TESTED BY	J.M.Wimett	CONTACT	Dave Weekes	PHONE			10/16/2001
					9601 pc	z)	
SAMPLE	SIEVE	CUMULATIVE	% WEIGHT	%	Grain Size	COMMENT	s
WT (g)	SIZE IN.	WEIGHT(g)	RETAINED	PASSING	(mm)		
967.70	2"	0.0	0.0	100.0	50.80		
	1.5"	0.0	0.0	100.0	38.10		
	3/4"	170.6	17.6	82.4	19.05		
	3/8"	278.6	28.8	71.2	9.42		
	#4	378.3	39.1	60.9	4.70		
	#10	561.3	58.0	42.0	1.98		
	#20	669.2	69.2	30.8	0.83		
	#40	718.6	74.3	25.7	0.42		
	#60	756.0	78.1	21.9	0.25		
	#100	801.8	82.9	17.1	0.150		
	#200	851.3	88.0	12.0	0.074		

Sieve Analysis Data for Sample W18-40=250.0

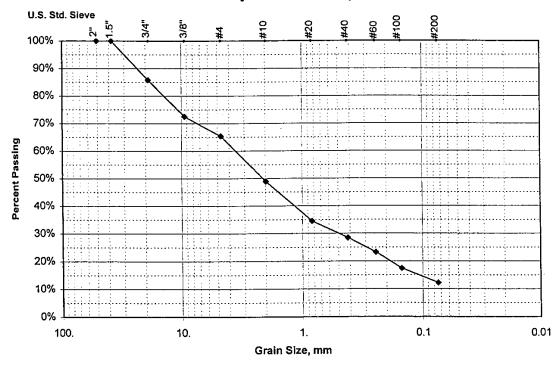




CH2M Hill Hanford, Inc. SIEVE ANALYSIS

WELL NAME	299-W19-44	DEPTH	232.0'-234.5'	SAMPLE#	W19-44-232.0	WELL ID#	C3393
TESTED BY	J.M.Wimett	CONTACT	Dave Weekes	PHONE		DATE	09/06/2001
			2		9601	7pJ	
SAMPLE	SIEVE	CUMULATIVE	% WEIGHT	%	Grain Size	COMMEN	TS
WT (g)	SIZE IN.	WEIGHT(g)	RETAINED	PASSING	(mm)		
950.60	2"	0.0	0.0	100.0	50.80		
	1.5"	0.0	0.0	100.0	38.10		
	3/4"	135.0	14.2	85.8	19.05		
	3/8"	261.4	27.5	72.5	9.42]
	#4	329.4	34.7	65.3	4.70		
	#10	486.0	51.1	48.9	1.98		
	#20	622.6	65.5	34.5	0.83		
	#40	680.0	71.5	28.5	0.42		
	#60	729.9	76.8	23.2	0.25		
	#100	785.2	82.6	17.4	0.150		
	#200	834.6	87.8	12.2	0.074		

Sieve Analysis Data for Sample W19-44-232.0



Comments: Silty Sandy Gravel

All data are accurately and completely recorded.

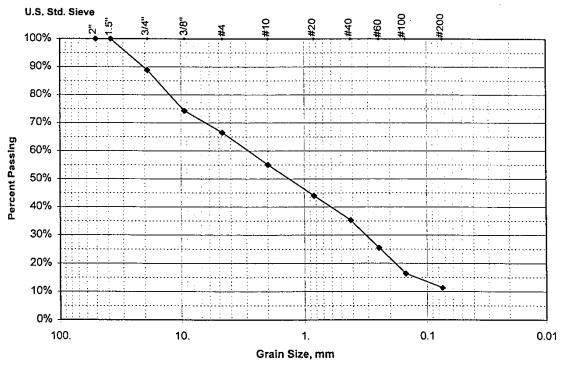
Checked By: Male kee / IX Weekes Date: 10/19/0/

CH2M Hill Hanford, Inc.

SIEVE ANALYSIS

WELL NAME	299-W19-44	DEPTH	267.0'-269.5'	SAMPLE#	W19-44-232.0	WELL ID#	C3393
TESTED BY	J.M.Wimett	CONTACT	Dave Weekes	PHONE		DATE	09/06/2001
					9601 JC	a/	
SAMPLE	SIEVE	CUMULATIVE	% WEIGHT	%	Grain Size	COMMEN	TS
WT (g)	SIZE IN.	WEIGHT(g)	RETAINED	PASSING	(mm)		ŀ
981.70	2"	0.0	0.0	100.0	50.80		
	1.5"	0.0	0.0	100.0	38.10		
	3/4"	110.2	11.2	88.8	19.05		
	3/8"	252.7	25.7	74.3	9.42		
	#4	328.7	33.5	66.5	4.70		
	#10	441.3	45.0	55.0	1.98		
	#20	550.1	56.0	44.0	0.83		
	#40	634.8	64.7	35.3	0.42		
	#60	731.5	74.5	25.5	0.25		
	#100	820.5	83.6	16.4	0.150		
	#200	870.9	88.7	11.3	0.074		

Sieve Analysis Data for Sample W19-44-232.0



Comments: Silty Sandy Gravel

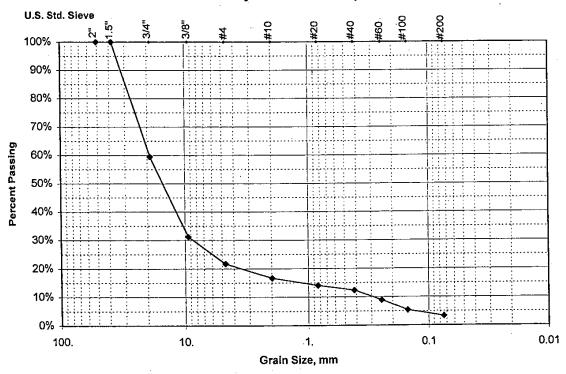
All data are accurately and completely recorded.

Checked By: Weeker/DCWeekes Date: /0/19/01

CH2M Hill Hanford, Inc. SIEVE ANALYSIS

WELL NAME	299-W19-45	DEPTH	224.0'-226.0'	SAMPLE#	W19-45-224.0	WELL ID#	C3394
TESTED BY	J.M,Wimett	CONTACT	Dave Weekes	PHONE		DATE	09/13/2001
					9601 N	% /	
SAMPLE	SIEVE	CUMULATIVE	% WEIGHT	%	Grain Size	COMMEN	TS
WT (g)	SIZE IN.	WEIGHT(g)	RETAINED	PASSING	(mm)		
980.00	2"	0.0	0.0	100.0	50.80		
	1.5"	0.0	0.0	100.0	38.10		
	3/4"	397.3	40.5	59.5	19.05		
	3/8"	674.3	68.8	31.2	9.42		
	#4	766.8	78.2	21.8	4.70		
	#10	816.0	83.3	16.7	1.98		
	#20	842.3	85.9	14.1	0.83		
	#40	858.9	87.6	12.4	0.42		
	#60	892.9	91.1	8.9	0.25		
	#100	927.6	94.7	5.3	0.150		
	#200	947.9	96.7	3.3	0.074		

Sieve Analysis Data for Sample W19-45-224.0



Comments: Sandy Gravel

All data are accurately and completely recorded.

Checked By: Markey Dewekes Date: 10/19/01

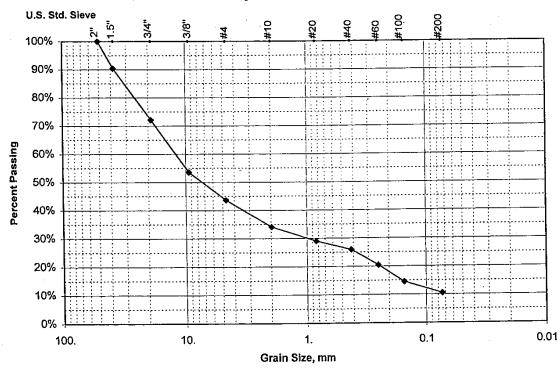
CH2M Hill Hanford, Inc.

WELL NAME	299-W19-45	DEPTH	258.0'-259.0'	SAMPLE#	W19-45-258.0	WELL ID#	C3394
TESTED BY	J.M.Wimett	CONTACT	Dave Weekes	PHONE	372-9130	DATE	09/13/2001

SIEVE ANALYSIS

SAMPLE	SIEVE	CUMULATIVE	% WEIGHT	%	Grain Size	COMMENTS
WT (g)	SIZE IN.	WEIGHT(g)	RETAINED	PASSING	(mm)	
976.90	2"	0.0	0.0	100.0	50.80	
L	1.5"	93.7	9.6	90.4	38.10	
	3/4"	272.3	27.9	72.1	19.05	
	3/8"	453.9	46.5	53.5	9.42	
	#4	550.8	56.4	43.6	4.70	
	#10	644.2	65.9	34.1	1.98	
	#20	693.5	71.0	29.0	0.83	
. 1	#40	723.3	74.0	26.0	0.42	
	#60	777.3	79.6	20.4	0.25	
	#100	835.2	85.5	14.5	0.150	
	#200	875.0	89.6	10.4	0.074	<u> </u>

Sieve Analysis Data for Sample W19-45-258.0



Comments: Silty Sandy Gravel

All data are accurately and completely recorded.

Checked By: All The first INC Weeks. Date: 10/19/01

Appendix C

Borehole Geophysical Logs

Appendix C

Borehole Geophysical Logs

This appendix contains the borehole geophysical logs obtained from boreholes 299-W18-40, 299-W19-44, and 299-W19-45. The logs were run and analyzed by MACTEC-ERS. The Log Data Reports are included with the logs.



299-W18-40 (C3395)

Log Data Report

Borehole Information:

Borehole: 299-W18-40 (C3395)			Site:	South of U Tank Fa	ırm
Coordin	ates (Plant)	GWL (ft) ¹ :	228	GWL Date:	9/19/01
North	East	Drill Date	TOC' Elevation	Total Depth (ft)	Туре
Unknown	Unknown	Sept. 2001	Unknown	260	Cable Tool

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom
	Ottokup (it)	\"""	\111./	(111.)	(11/)	(ft)
Steel	2.7	10 7/8	9 3/8	11/16	2.7	258

Borehole Notes:

The BHI site geologist reported the GWL as an approximate depth. The logging engineer measured the pipe stickup at the borehole using a steel tape. Calipers were used to measure casing OD and thickness only; the casing ID is calculated.

Logging Equipment Information:

Logging System:	Gamma 2A		Type: SGLS (35%)	
Calibration Date:	09/00	Calibration Reference:	GJO-2001-246-TAR	
		Logging Procedure:	MAC-HGLP 1,6,5	

Logging System:	Gamma 2E		Type: NMLS
Calibration Date:	05/01	Calibration Reference:	GJO-2001-247-TAR
		Logging Procedure:	MAC-HGLP 1.6.5

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3	4
Date	09/20/01	09/20/01	09/21/01	
Logging Engineer	Spatz	Spatz	Spatz	
Start Depth (ft)	0	120.0	244.0	
Finish Depth (ft)	121.0	260.0	218.0	
Count Time (sec)	200	200	200	
Live/Real	R	R	R	
Shield (Y/N)	N/A³	N/A	N/A	
MSA Interval (ft)	1.0	1.0	1.0	1. 11.
ft/min	N/A	N/A	N/A	
Pre-Verification	B0056CAB	B0056CAB	B0056CAB	
Start File	B0056000	B0056122	B0056263	
Finish File	B0056121	B0056262	B0056289	
Post-Verification	B0056CAA	B0056CAA	B0056CAA	· · · · = 2
Depth Return Error (ft)	+0.4	N/A	-0.25	
Comments				

Neutron Moisture Logging System (NMLS) Log Run Information:

Log Run	1	2	3	4
Date	09/19/01	09/20/01		
Logging Engineer	Spatz	Spatz		
Start Depth (ft)	0	198.0		
Finish Depth (ft)	231.0	175.0	*·····	
Count Time (sec)	15	15		
Live/Real	L	L		
Shield (Y/N)	N/A	N/A	,, ·	
MSA Interval (ft)	0.25	0.25		
ft/min	N/A	N/A		
Pre-Verification	C0017CAB	C0017CAB		<u>.</u>
Start File	C0017000	C0R17000	·	
Finish File	C0017928	C0R17092		
Post-Verification	C0R17CAA	C0R17CAA		
Depth Return Error (ft)	N/A	0	· <u></u>	
Comments	Water detected below 231.0 ft.	Repeat interval.		

Logging Operation Notes:

Zero reference is the top of ground surface, and SGLS log depths are relative to ground level.

A longer count time (200 sec) was required with the SGLS because of the relatively thick casing. The borehole was logged in the drill pipe before completion as a groundwater monitoring well. In order to obtain reliable spectra while minimizing overall logging time, the depth interval was increased from 0.5 ft to 1.0 ft.

Fine gain adjustments were made after files B0056013 (13.0 ft), B0056040 (40.0 ft), B0056059 (59.0 ft), and B0056076 (76.0 ft) during logging run 1.

Log run 1 was terminated to refill the sonde with liquid nitrogen and to grease the PTO driveline.

Two spectra, files B0056261 and B0056262, may be from the sonde sitting on the bottom of the borehole in thick watery mud and may not represent true depth intervals.

During logging, the sonde is centralized in the borehole for both the SGLS and NMLS.

Analysis Notes:

L	Analyst:	Sobczyk	Date:	09/25/01	Reference:	MAC-VZCP 1.7.9 Rev. 2

Pre-run and post-run verification spectra for the SGLS were evaluated. The pre-survey verification spectrum (file B00056CAB) was within the control limits. However, the peak intensity for the 609-keV photopeak was below the lower warning limits for this pre-run verification spectrum. The post-survey verification spectrum for the logging (file B00056CAA) was below the lower control limits for all three of the peak intensities. On the basis of the acceptance criteria for the Gamma 2A system, both the pre- and post-verification spectra did not fulfill the acceptance criteria. Examinations of spectra indicate that the detector appears to have functioned normally during the log run, and the log data are provisionally accepted, subject to further review and analysis.

Individual spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated with EXCEL. Corrections were applied for a casing thickness of 11/16 in. from the ground surface to 260 ft. A correction for water in the borehole was applied below 230 ft, and this depth was determined from the neutron-moisture log. Dead time corrections were not necessary. The rerun of the SGLS showed good repeatability.

Pre-run and post-run verification spectra for the NMLS were evaluated. The pre-survey verification spectrum (file C0017CAB) recorded 723 gross cps while the post-survey verification spectrum (file C0R17CAA) recorded 747 gross cps.

Moisture calibration models at Hanford for 10-in. holes with 11/16-in. casing have not been established. Thus, the neutron log was not processed to estimate volumetric moisture content because the relatively large borehole diameter and casing thickness are beyond the range of conditions for which the tool was calibrated. Neutron data are presented as gross counts. In general, an increase in neutron count is indicative of an increase in moisture content, but a quantitative calculation of volumetric moisture cannot be made at this time. The rerun of the neutron-moisture tool showed good repeatability.

Log Plot Notes:

Separate log plots are provided for gross gamma, naturally occurring radionuclides (40 K, 232 Th, 238 U, and associated decay progeny), and man-made radionuclides. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, or casing and water corrections. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation. A gross neutron log of neutron counts is also shown on the combination plot.

Results and Interpretations:

¹³⁷Cs was the only man-made radionuclide detected. ¹³⁷Cs activity was detected at two points near the ground surface. The measured ¹³⁷Cs activity was about 0.2 pCi/g at both the ground surface and at a log depth of 3 ft.

The changes in gross gamma counts depend primarily upon changes in 40 K activities. The increase in gross gamma counts from about 75 cps to about 115 cps at a log depth of 69 ft corresponds with an increase in apparent 40 K activity from about 10 to 15 pCi/g. This increase in total gamma is interpreted as the Hanford H2. The increase in 232 Th activity from about 0.8 to 1.0 pCi/g and the increase in gross gamma counts from 110 to 125 cps at 116 ft probably represent the top of the Early Palouse Soil. On the basis of low K-40 activities, the carbonate-rich paleosols of the Pliocene-Pleistocene are interpreted as being between 133 and 137 ft. The caliche layer with characteristically high uranium content (greater than 2.0 pCi/g) is present between 133 and 135 ft. The top of the Ringold is picked at 138 ft.

The neutron moisture tool's depressed response in this hole is due at least in part to the low-activity source, short source-to-detector spacing, and large borehole diameter. The highest neutron counts occurred in the groundwater as expected. The higher neutron counts that occurred in the 115- to 137-ft interval correspond with the Plio-Pleistocene as interpreted from the SGLS data.

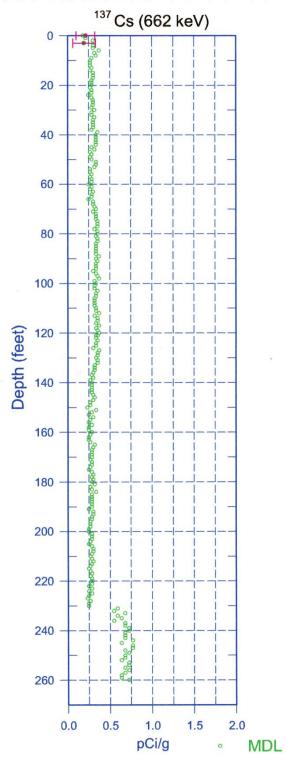
_

¹ GWL – groundwater level

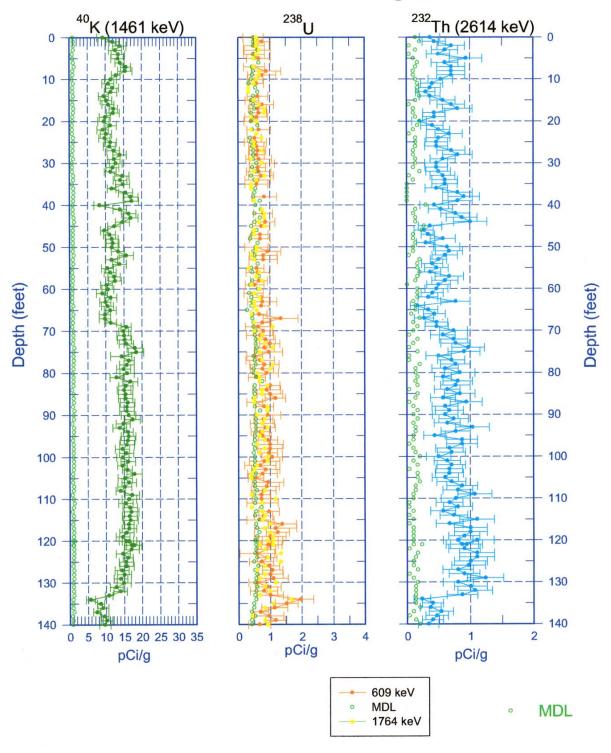
² TOC – top of casing

³ N/A – not applicable

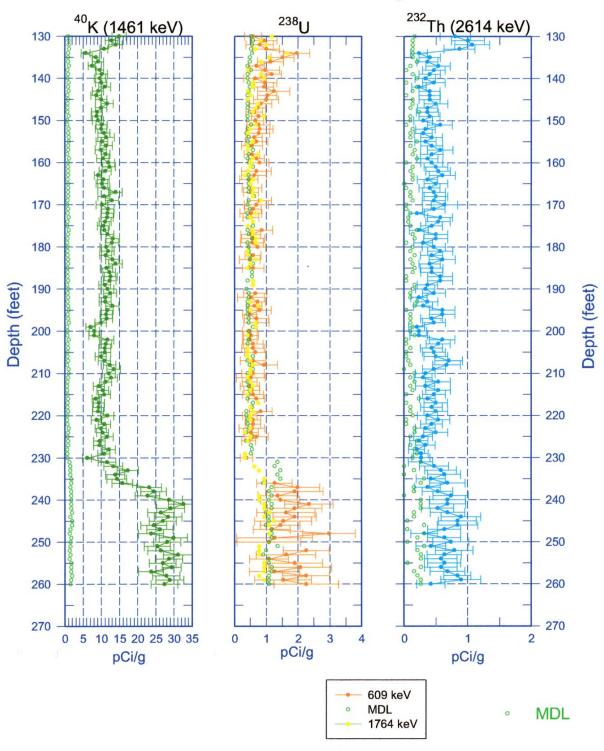
299-W18-40 (C3395) Man-Made Radionuclide Concentrations



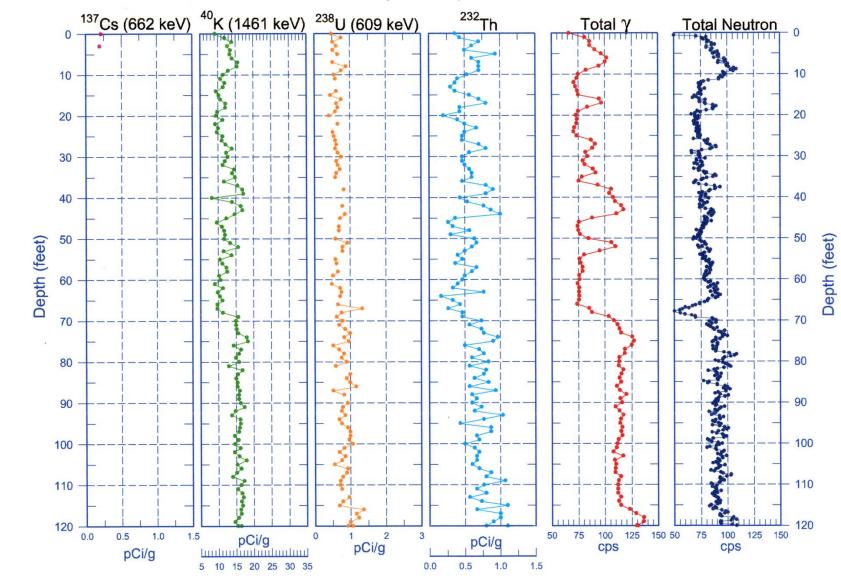
299-W18-40 (C3395) Natural Gamma Logs



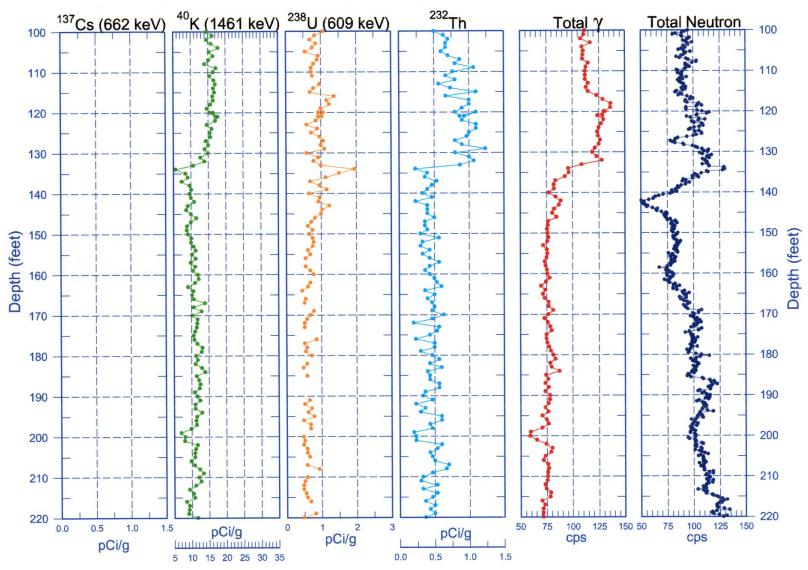
299-W18-40 (C3395) Natural Gamma Logs



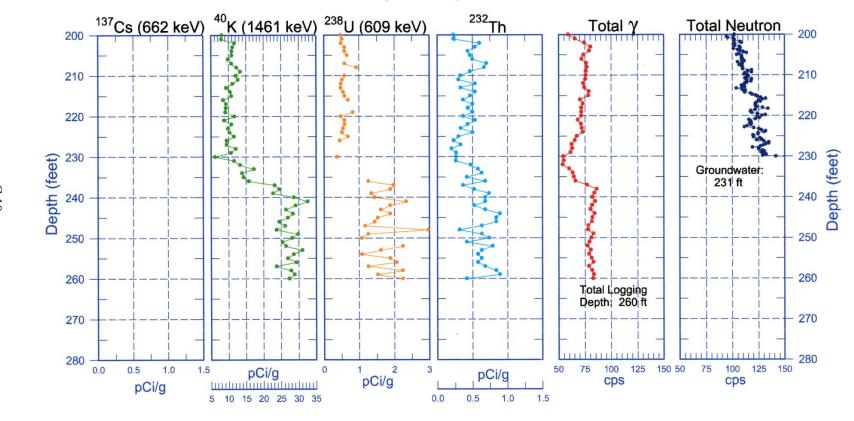
299-W40-18 (C3395) Combination Plot



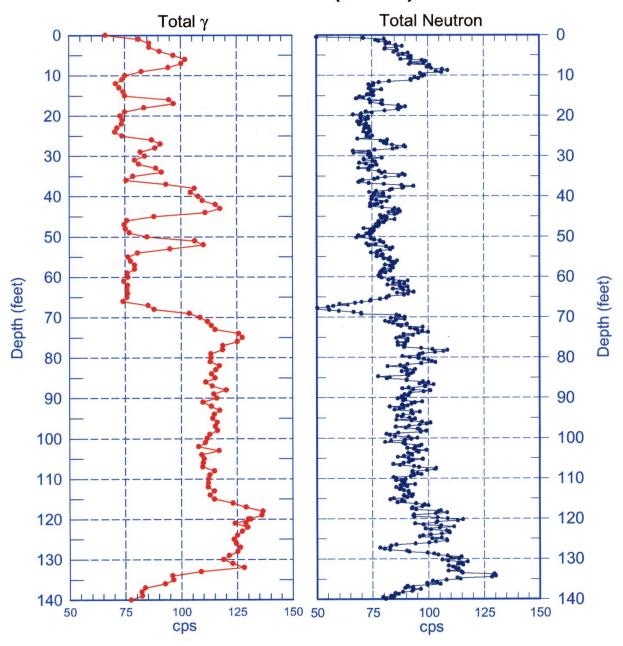
299-W40-18 (C3395) Combination Plot



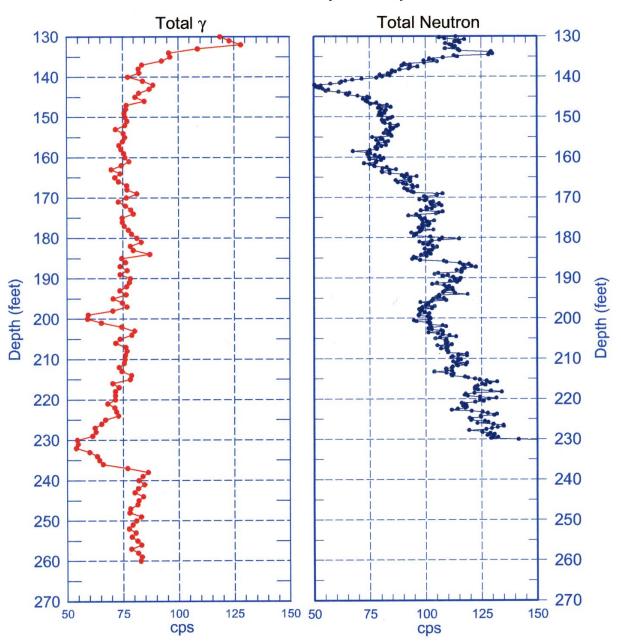
299-W40-18 (C3395) Combination Plot



299-W18-40 (C3395)

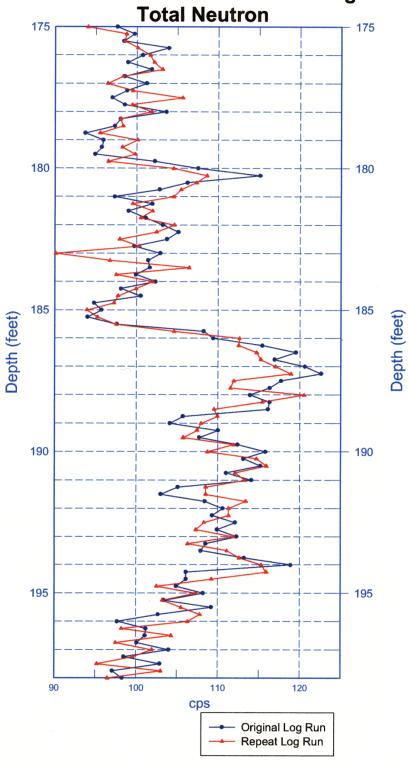


299-W18-40 (C3395)

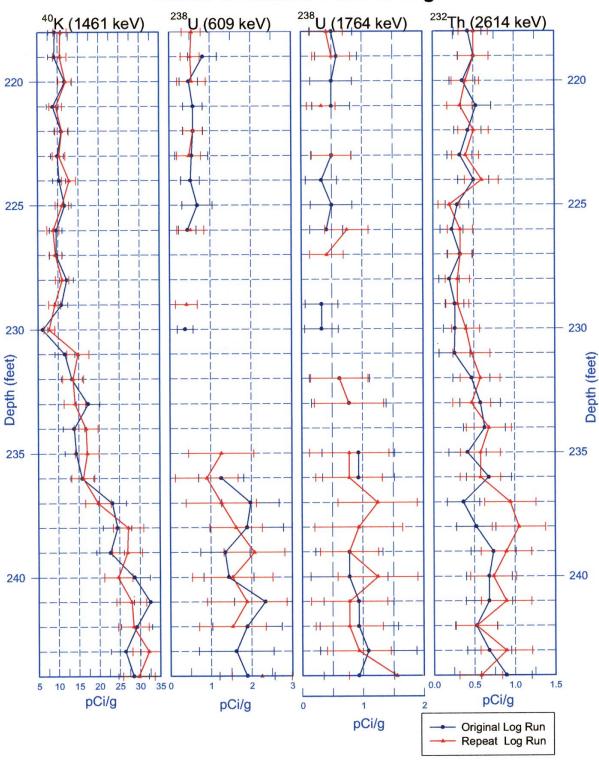


299-W18-40 (C3395)

Rerun of Neutron-Moisture Log



299-W18-40 (C3395) Rerun of Natural Gamma Logs





Log Data Report

Borehole Information:

Borehole: 299-W	19-44 (C3393)		Site:	U Farm Perimeter	
Coordin	ates	GWL' (ft):	~230	GWL Date: 8/	30/01
North	East	Drill Date	TOC [*] Elevation	Total Depth (ft)	Туре
N/A ³	N/A	8/01	NA	272	Cable

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Steel	0.6	11.75	10.25	0.75	0	61
Steel	2.23	8.75	7.75	0.5	0	272

Borehole Notes:

This borehole is a RCRA groundwater well. The logging engineer measured the casing stickup at the borehole using a steel tape and caliper. Explosive environment (high hydrogen) exists at this borehole per Tim Hottle (BHI). The inside diameter of the 12-inch casing could not be measured because of interference from the 8-inch casing. Very windy weather and much dust were experienced during logging in the late PM. SGLS logging detected groundwater below 231 ft.

Logging Equipment Information:

Logging System:	Gamma 2B		Type: SGLS (35%)
Calibration Date:	09/00	Calibration Reference:	GJO-2001-245-TAR
		Logging Procedure:	MAC-HGLP 1.6.5

Logging System:	Gamma 2E		Type: NMLS
Calibration Date:	05/01	Calibration Reference:	GJO-2001-247-TAR
		Logging Procedure:	MAC-HGLP 1.6.5

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3	4	5	6
Date	9/04/01	9/04/01	9/04/01	9/05/01	9/05/01	
Logging Engineer	Musial	Musial	Musial	Musial	Musial	
Start Depth (ft)	0	135.0	245.0	244.0	250.0	
Finish Depth (ft)	135.0	245.0	225.0	270.0	255.0	
Count Time (sec)	200	200	200	200	200	
Live/Real	R	R	R	R	R	
Shield (Y/N)	N	N	N	N	N	
MSA Interval (ft)	1.0	1.0	1.0	1.0	1.0	
ft/min	n/a⁴	n/a	n/a	n/a	n/a	
Pre-Verification	B0043CAB	B0043CAB	B0043CAB	B0044CAB	B0044CAB	
Start File	B0043000	B0043136	B0043247	B0044000	B0044027	
Finish File	B0043135	B0043246	B0043272	B0044026	B0044032	
Post-Verification	B0043CAA	B0043CAA	B0043CAA	B0044CAA	B0044CAA	

Neutron Moisture Logging System (NMLS) Log Run Information:

Log Run	1	2	3	4	5	6
Date	9/05/01	9/05/01	9/05/01	9/05/01		
Logging Engineer	Musial	Musial	Musial	Musial		
Start Depth (ft)	60	144.5	182.75	150.0		
Finish Depth (ft)	145.0	182.75	230.86	160.0		
Count Time (sec)	na	na	15	na		
Live/Real	na	na	R	na		
Shield (Y/N)	N	N	N	N		
MSA Interval (ft)	0.25	0.25	0.25	0.25		
ft/min	1.0	1.0	na	1.0		1
Pre-Verification	C0014CAB	C0014CAB	C0014CAB	C0014CAB		
Start File	C0014000	C0014341	C0015495	C0016000		
Finish File	C0014340	C0014494	C0015687	C0016040		
Post-Verification	C0016CAA	C0016CAA	C0016CAA	C0016CAA		

Logging Operation Notes:

A longer count time (200 sec) was required with the SGLS because of the relatively thick casing. In order to obtain reliable spectra while minimizing overall logging time, the depth interval was increased from 0.5 to 1.0 ft.

Log depths are relative to ground level.

The pre-run verification B0043CAB file passed the verification criteria.

Fine gain adjustment at 78.0 ft (file B0043078).

Fine gain adjustment at 103.0 ft (file B0043103).

Fine gain adjustment at 135.0 ft (file B0043136).

The pre-run verification B0044CAB file passed the verification criteria.

The neutron moisture tool was run centralized.

Analysis Notes:

ì	Analyst: Sobczy	k Date: 09/11/01	Reference:	MAC-VZCP 1.7.9, Rev. 2

Pre-run and post-run verification spectra for the SGLS were evaluated. All of the pre-survey and post-survey verification spectra were within the control limits. The post-survey verification spectra for all logging runs (files B0043CAA and B00044CAA) were outside of the lower warning limits for the peak counts per second at 609, 1461, and 2615 keV. Examinations of spectra indicate that the detector appears to have functioned normally during the log run. Individual spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated with EXCEL. Corrections were applied for a casing thickness of 1.25 inches from the ground surface to 60 ft and 0.5 inch from 61 to 270 ft. A correction for water in the borehole was applied at and below 231 ft. Dead time corrections were not necessary. The first and second reruns of the SGLS show good repeatability.

Pre-run and post-run verification spectra for the NMLS were evaluated. The pre-survey verification spectrum recorded 711 gross cps, while the post-survey verification spectrum recorded 799 gross cps.

Moisture calibration models at Hanford for 8-inch-diameter casing with 0.322-inch thickness have been established. A casing thickness correction (relative to 8-inch casing) can be estimated. Thus, corrections were applied to the gross neutron counts per second to estimate volumetric moisture content with the established 8-inch hole-size correction and the 0.5-inch casing thickness for 8-inch-diameter casing. Neutron data are also presented as gross counts and percent moisture by volume. In general, an increase in

neutron count is indicative of an increase in moisture content. The rerun of the neutron-moisture tool shows good repeatability.

Log Plot Notes:

Separate log plots are provided for gross gamma, naturally occurring radionuclides (40 K, 232 Th, 238 U, and associated decay progeny), and man-made radionuclides. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). 238 U activity based on both the 609- and 1764-keV photopeaks are plotted. The open circles indicate the minimum detectable activity (MDA) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and does not include errors associated with the inverse efficiency function, dead time correction, or casing and water corrections. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation. A neutron moisture log of percent moisture by volume is also shown on the combination plot.

Results and Interpretations:

¹³⁷Cs was the only man-made radionuclide detected. ¹³⁷Cs activity was detected at a log depth of 3.0 ft. The measured ¹³⁷Cs activity was 0.4 pCi/g and is interpreted as surface contamination. A marginal peak at 1408 keV was observed at 192 ft (file B0043193); this peak is interpreted as the ²³⁸U (²¹⁴Bi) 1407.98-keV peak, not the ¹⁵²Eu 1408.01-keV peak, because virtually no contamination was detected in this borehole.

The large apparent increase in total gamma counts per second at 61 ft is due to the change from a double to single string of casing at 61 ft. The casing correction for two strings of casing was applied from the ground surface to 60 ft instead of 61 ft because the log data appeared to be over corrected at 61 ft if the correction for two casing strings were applied at 61 ft. Casing correction is not applied to gross gamma data, because the casing correction factor is energy dependent. The decrease in total gamma counts per second at 231 ft is due to groundwater in the borehole shielding the detector. Changes in MDA at 60 and 231 ft are due to changes in casing configuration and groundwater. The increase in apparent ⁴⁰K activity from about 13 to 19 pCi/g at about 51 ft is interpreted as the top of the Hanford H2. The increase in ²³²Th activity from about 0.8 to 1.2 pCi/g and the increase in gross gamma counts from 160 to 190 cps at 130 ft probably represents the top of the Early Palouse Soil. On the basis of low K-40 activities, the carbonate rich paleosols of the Pliocene-Pleistocene are interpreted as being between 144 and 147 ft. The caliche layer with characteristically high uranium content (greater than 1.5 pCi/g) is present between 145 and 146 ft. The top of the Ringold is picked at 147 ft.

The neutron moisture tool's depressed response in this hole is due to the low-activity source and short source-to-detector spacing. The highest neutron counts occurred in the groundwater as expected. The elevated neutron counts per second that occur at about 129 through 147 ft corresponds with the Plio-Pleistocene as interpreted from the SGLS data.

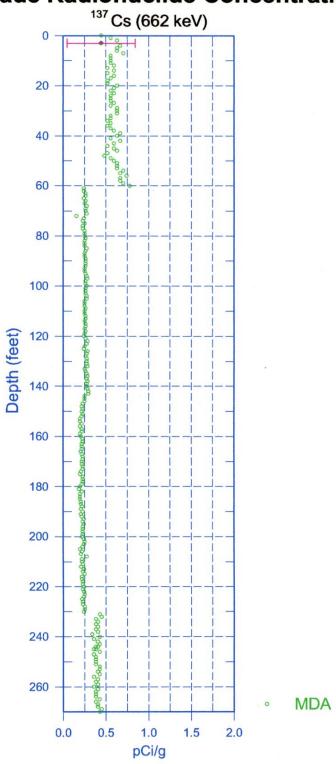
¹ GWL - groundwater level

² TOC – top of casing

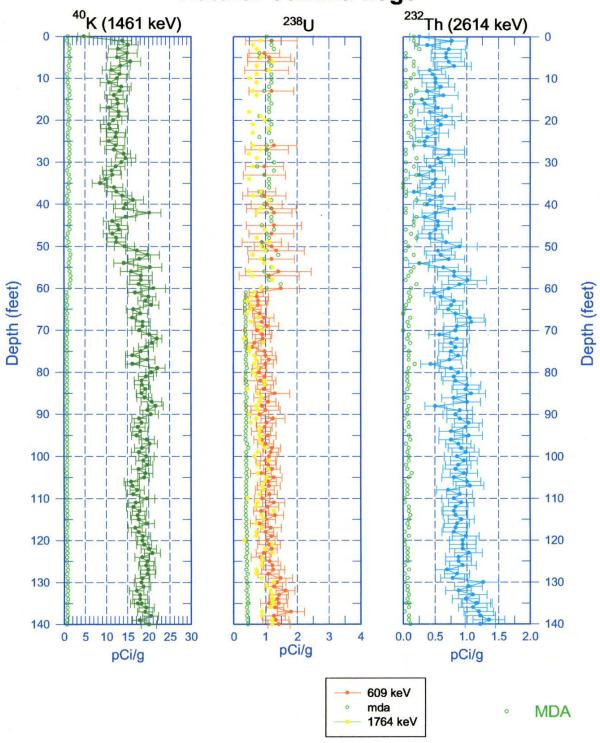
³ N/A – not available

⁴ n/a – not applicable

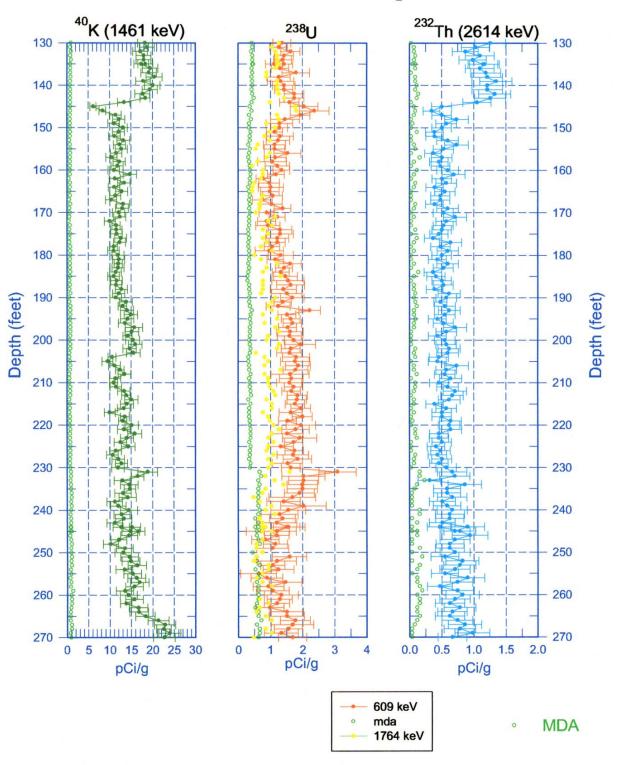
299-W19-44 (C3393) Man-Made Radionuclide Concentrations



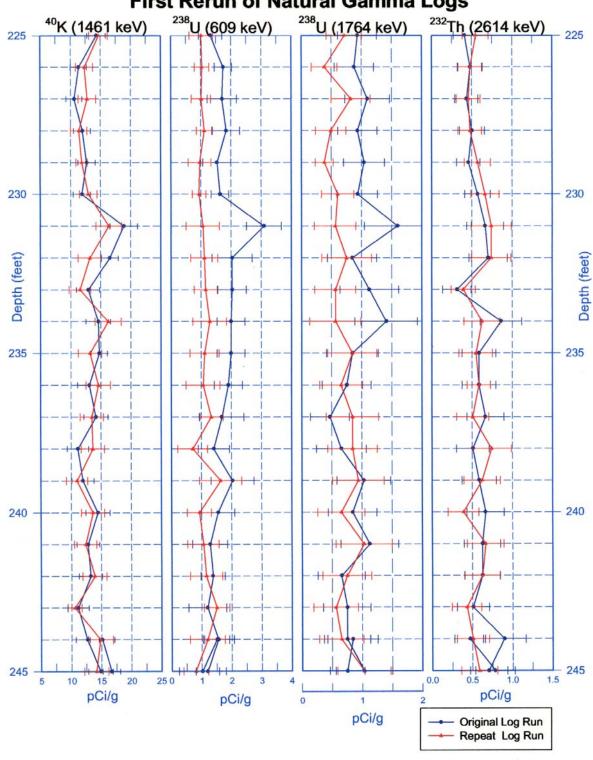
299-W19-44 (C3393) Natural Gamma Logs



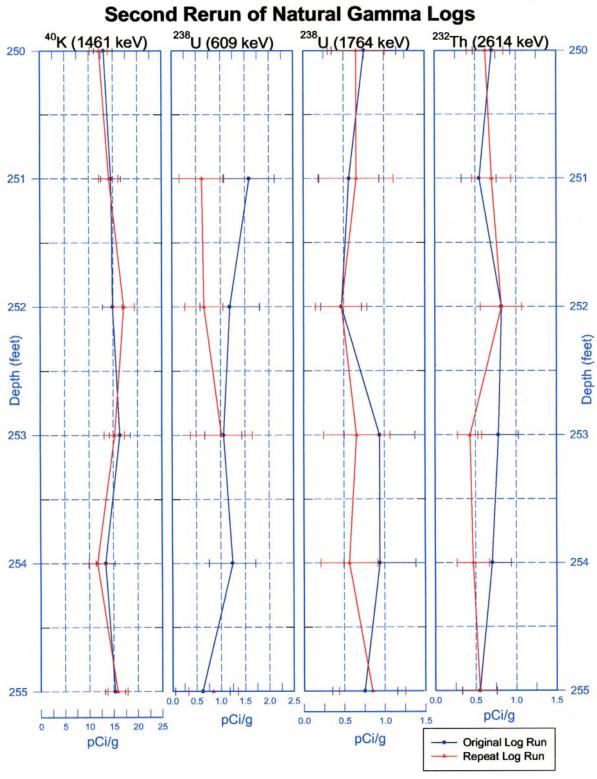
299-W19-44 (C3393) Natural Gamma Logs



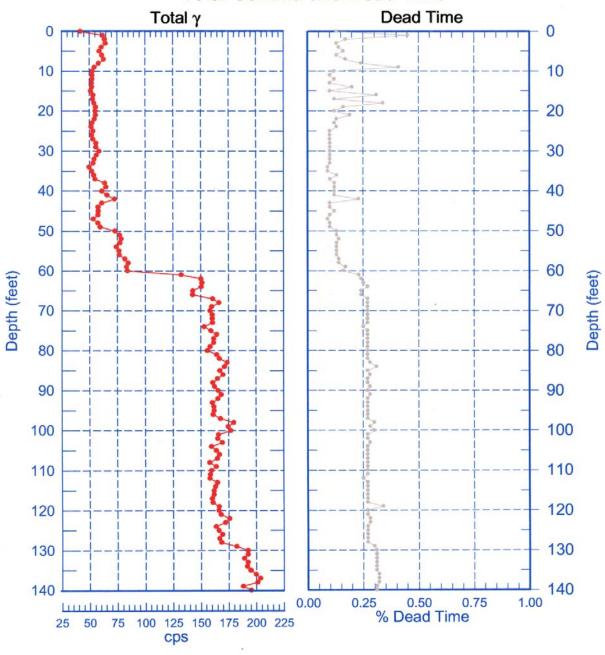
299-W19-44 (C3393) First Rerun of Natural Gamma Logs



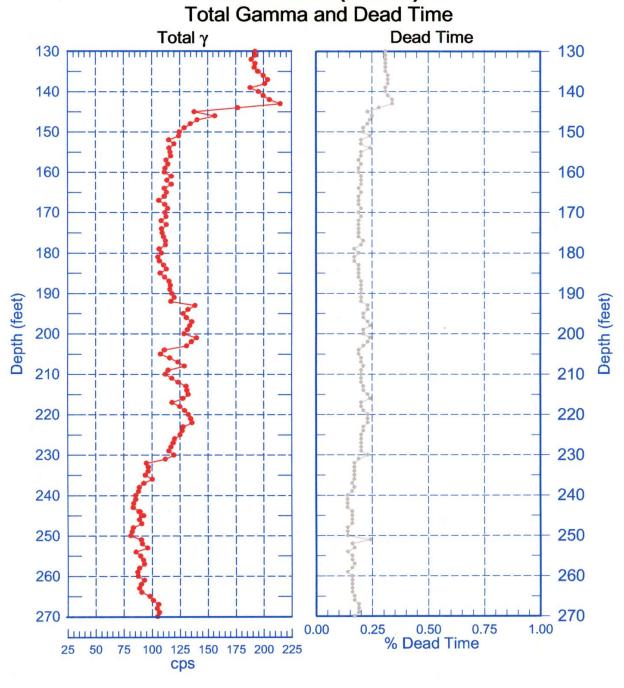
299-W19-44 (C3393)

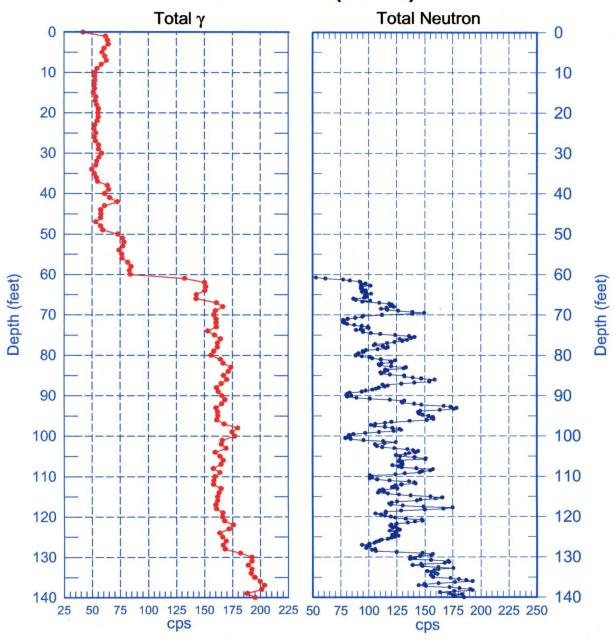


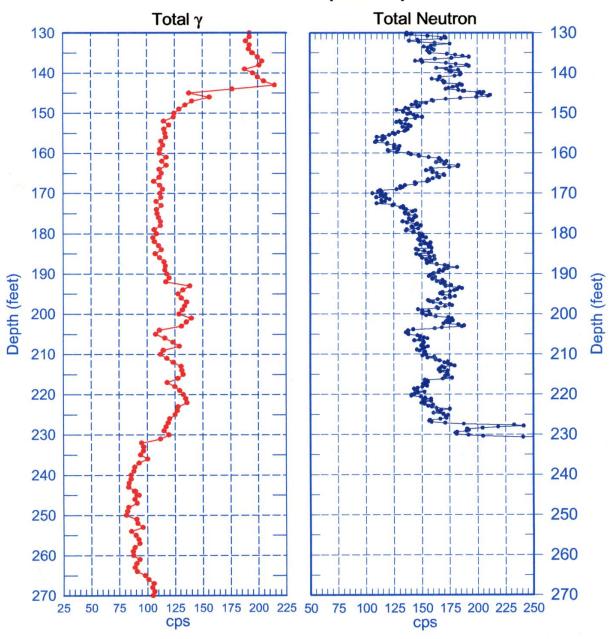
299-W19-44 (C3393)
Total Gamma and Dead Time

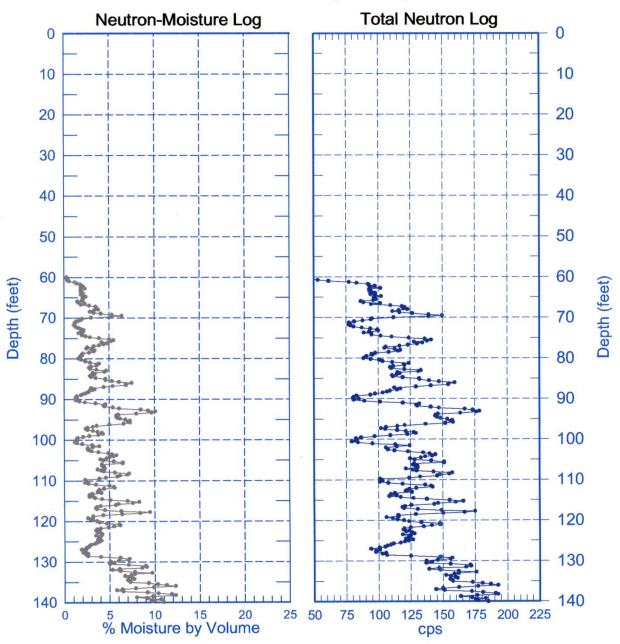


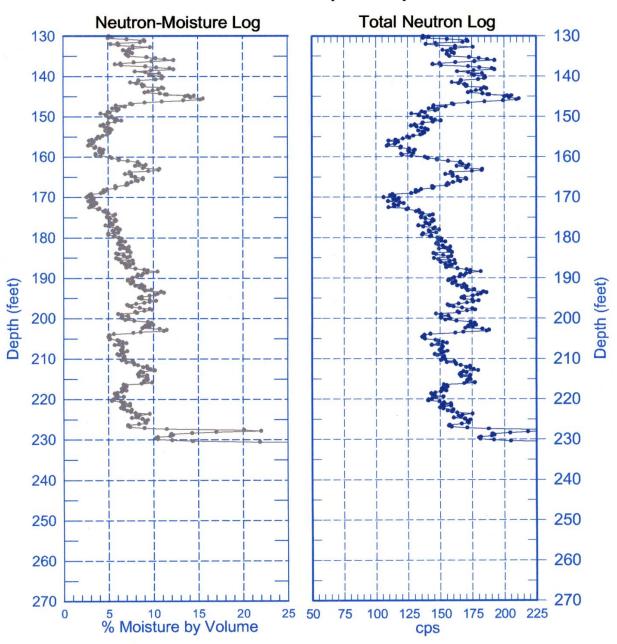
299-W19-44 (C3393)



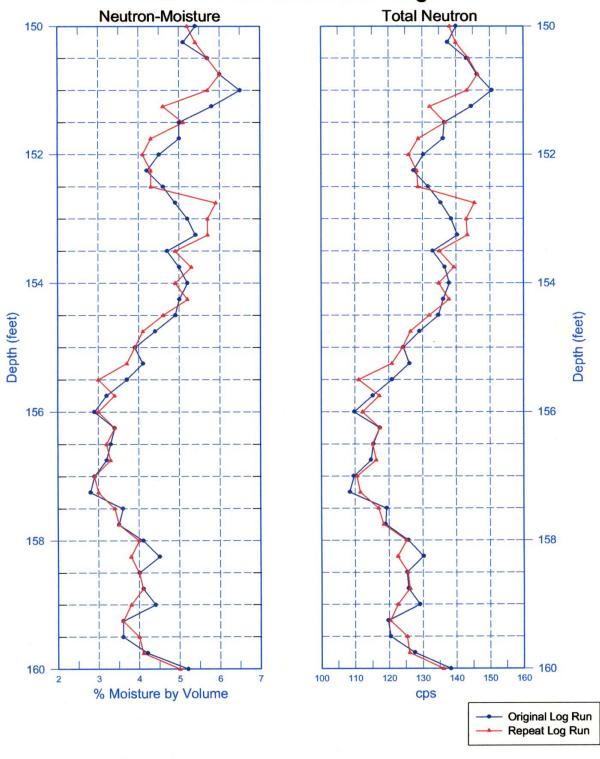




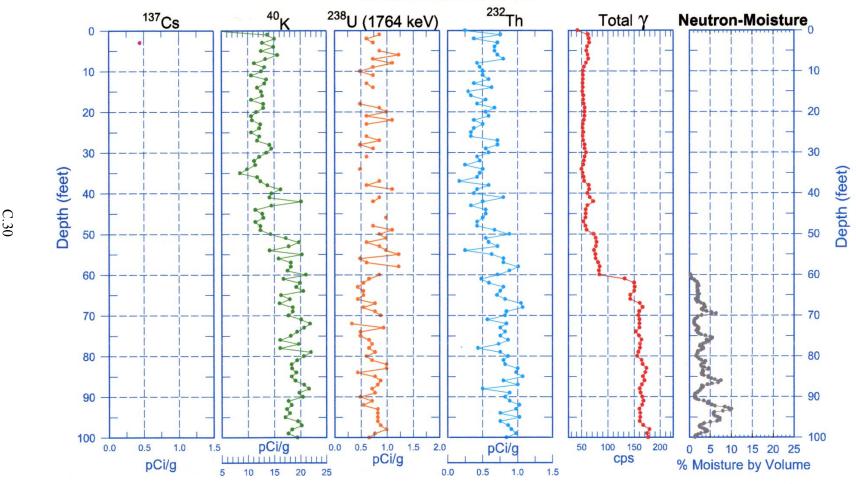




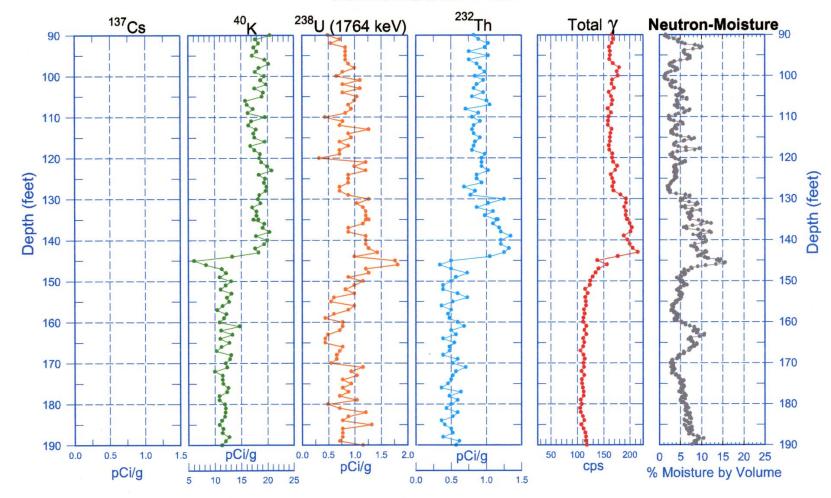
299-W19-44 (C3393) Rerun of Neutron-Moisture Logs



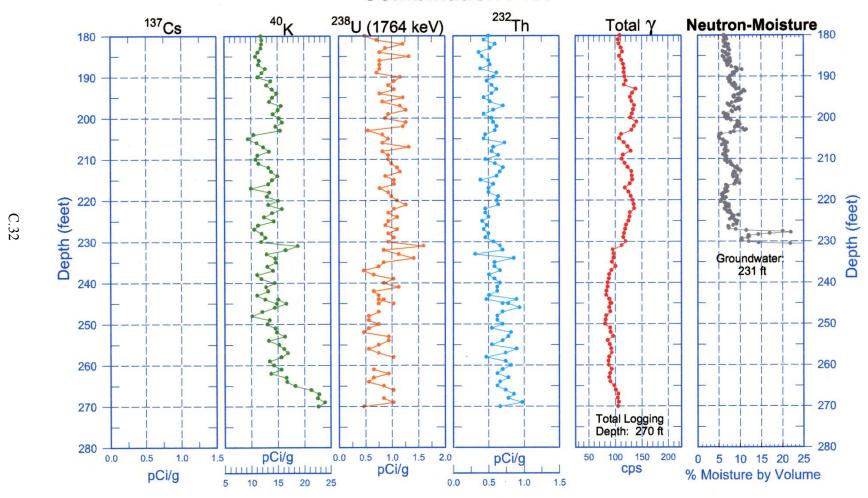
299-W19-44 (C3393) Combination Plot



299-W19-44 (C3393) Combination Plot



299-W19-44 (C3393) Combination Plot





Log Data Report

Borehole Information:

Borehole:	299-W19-45 (C339	94)	Site:	U Farm Perimeter	
Coord	linates	GWL (ft) ':	~224.3	GWL Date:	8/15/01
North	East	Drill Date	TOC ² Elevation	Total Depth (ft)	Туре
N/A ³	N/A	8/01	N/A	266.1	air rotary

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Steel threaded drill pipe	0.25	8.25	7.25	.75	0	266.1

Borehole Notes:

This borehole is a RCRA groundwater well that was logged through the drill pipe.

Logging Equipment Information:

Logging System:	Gamma	a 2B	Type:	SGLS (35%)
Calibration Date:	9/00	Calibration Reference:	GJO-200)1-245-TAR
		Logging Procedure:	MAC-HG	LP 1.6.5

Logging System:	Gamma	a 2E	Type: NMLS	
Calibration Date:	5/01	Calibration Reference:	GJO-2001-247-TAR	
		Logging Procedure:	MAC-HGLP 1.6.5	

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2/Repeat	3	4/Repeat
Date	8/15/01	8/15/01	8/16/01	8/16/01
Logging Engineer	Musial	Musial	Musial	Musial
Start Depth (ft)	0	115	114	135
Finish Depth (ft)	115	103	266	150
Count Time (sec)	200	200	200	200
Live/Real	R	R	R	R
Shield (Y/N)	N	N	N	N
MSA Interval (ft)	1.0	1.0	1.0	1.0
ft/min	n/a⁴	n/a	n/a	n/a
Pre-Verification	B00036CAB	B00036CAB	B00037CAB	B00037CAB
Start File	B0036000	B0036116	B0037000	B0037153
Finish File	B0036115	B0036128	B0037152	B0037168
Post-Verification	B00036CAA	B00036CAA	B00037CAA	B00037CAA

Neutron Moisture Logging System (NMLS) Log Run Information:

Log Run	1	2	3/Repeat	
Date 8/16/01		8/16/01	8/16/01	
Logging Engineer	Musial	Musial	Musial	
Start Depth (ft)	0	111.75	110	
Finish Depth (ft)	111.75	225	88	
Count Time (sec)	n/a	n/a	n/a	
Live/Real	n/a	n/a	n/a	
Shield (Y/N)	N	N	N	
MSA Interval (ft)	0.25	0.25	0.25	
ft/min	1.0	1.0	1.0	
Pre-Verification	C0012CAB	C0012CAB	C0012CAB	
Start File	C0012000	C0012448	C0012901	
Finish File	C0012447	C0012900	C0012989	
Post-Verification	C0012CAA	C0012CAA	C0012CAA	

Logging Operation Notes:

A longer count time (200 sec) was required with the SGLS because of the relatively thick casing. The borehole was logged in the drill pipe before completion as a groundwater monitoring well. To obtain reliable spectra while minimizing overall logging time, the depth interval was increased from 0.5 to 1.0 ft.

SGLS log depths are relative to ground level. During logging runs, no fine gain adjustments occurred.

The pre-run verification B0036CAA file passed the verification criteria. The post-survey verification B0036CAA failed to meet the acceptance criteria. The counts of the 1460- and 2614- keV peaks were both below the warning limits, and the counts of the 609-keV peak were below the control limit. The tool, however, appears to be functioning normally. The counts of the 609- and 1460-keV peaks in the pre-survey verification B0037CAB were both below the warning limits, however, the tool appears to be functioning properly.

Neutron moisture logs were run on 8/16/01 using the RLS 1, and log depths are relative to ground level. The neutron moisture tool was run centralized.

Analysis Notes:

	Analyst:	Sobczyk	Date:	08/28/01	Reference:	MAC-VZCP 1.7.9 Rev. 2			

Pre-run and post-run verification spectra for the SGLS were evaluated. All of the pre-survey verification spectra were within the control limits. The post-survey verification spectrum for logging run 1 (file B00036CAA) was the only post-survey verification spectrum that was outside of the control limits. The peak counts per second for the 609-keV peak was below the lower control limits for this post-run verification spectra. Examinations of spectra indicate that the detector appears to have functioned normally during the log run. Individual spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated with EXCEL. Corrections were applied for a casing thickness of 3/4 in. from the ground surface to 266 ft. A correction for water in the borehole was applied below 224 ft. Dead time corrections were not necessary.

Moisture calibration models at Hanford for 10-in. holes with 3/4-in. casing have not been established. Thus, the neutron log was not processed to estimate volumetric moisture content because the relatively large borehole diameter and casing thickness are beyond the range of conditions for which the tool was calibrated. Neutron data are presented as gross counts. In general, an increase in neutron count is

indicative of an increase in moisture content, but a quantitative calculation of volumetric moisture cannot be made at this time.

Moisture calibration models at Hanford for 8-in. diameter casing with 0.322-in. thickness have been established. A casing thickness correction (relative to 8-in. casing) can be estimated. Thus, corrections were applied to the gross neutron cps to estimate volumetric moisture content with the established 8-in. hole-size correction and the 1/2-inch casing thickness for 8-in.-diameter casing. Neutron data are also presented as gross counts. In general, an increase in neutron count is indicative of an increase in moisture content.

The rerun of the neutron-moisture tool shows good repeatability, and the rerun may be off-depth by -0.25 ft compared to the original run.

Log Plot Notes:

Separate log plots are provided for gross gamma, naturally occurring radionuclides (40 K, 232 Th, 238 U, and associated decay progeny), and man-made radionuclides. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable activity (MDA) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and does not include errors associated with the inverse efficiency function, dead time correction, or casing and water corrections. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation. A neutron moisture log of neutron counts is also shown on the combination plot.

Results and Interpretations:

¹³⁷Cs was the only man-made radionuclide detected. ¹³⁷Cs activity was detected at the three points near the ground surface. The measured ¹³⁷Cs activity ranged from 0.4 to 1.4 pCi/g and is interpreted as surface contamination. A marginal peak at 1408 keV was observed at 140 ft (file B0037026); this peak is interpreted as the ²³⁸U (²¹⁴Bi) 1407.98-keV peak, not the ¹⁵²Eu 1408.01-keV peak, because it is in a caliche layer with a high ²³⁸U content.

The changes in gross gamma counts depend primarily upon changes in ⁴⁰K activities. The increase in gross gamma counts from about 85 cps to about 130 cps at a log depth of 53 ft corresponds with an increase in apparent ⁴⁰K activity from about 13 to 19 pCi/g. This increase in total gamma is interpreted as the Hanford H2. The increase in ²³²Th activity from about 0.8 to 1.2 pCi/g and the increase in gross gamma counts from 125 to 145 cps at 124 ft probably represent the top of the Early Palouse Soil. On the basis of low K-40 activities, the carbonate-rich paleosols of the Pliocene-Pleistocene are interpreted as being between 139 ft and 143 ft. The caliche layer with characteristically high uranium content (greater than 2.0 pCi/g) is present between 140 and 144 ft. The top of the Ringold is picked at 146 ft.

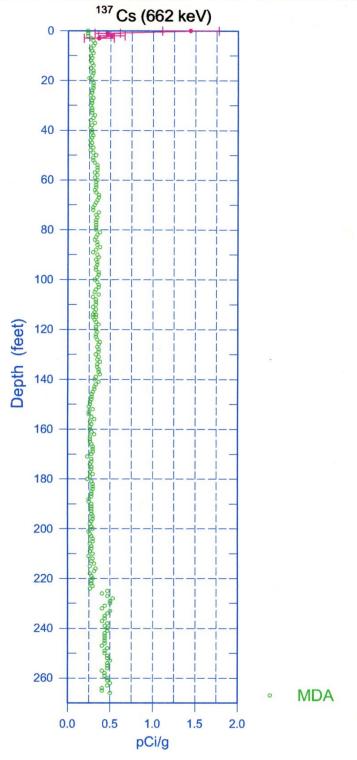
Below 224 ft, the apparent increase in ²³⁸U activity based on the 609-keV spectral line of about 1 pCi/g is greater than the apparent increase in ²³⁸U activity based on the 1764-keV line of about .25 pCi/g. This apparent increase in ²³⁸U at groundwater is probably the result of dissolved radon (²²²Rn) in the water. Quantification of naturally occurring ²³⁸U is based on measurement of the daughter ²¹⁴Bi, assuming that secular equilibrium has been attained. However, ²¹⁴Bi is also a short-term daughter of ²²²Rn. The presence of ²²²Rn is indicated by elevated counts in spectral peaks associated with ²¹⁴Pb and ²¹⁴Bi and does not indicate an increase in ²³⁸U. The fact that a discrepancy exists between the ²¹⁴Bi lines at 609 and 1764 keV suggests that radon and its daughters are present within the water. The apparent concentration based on the 609-keV peak appears to increase more than that based on the 1764-keV peak because the water correction factor decreases with increasing energy level. If the source of the gamma photons is within the water, then there is less attenuation than would be expected, and the effect of the water correction is an apparent increase in the calculated concentration.

The neutron moisture tool's depressed response in this hole is due to the low-activity source, and short source-to-detector spacing. The highest neutron counts occurred in the groundwater as expected. The

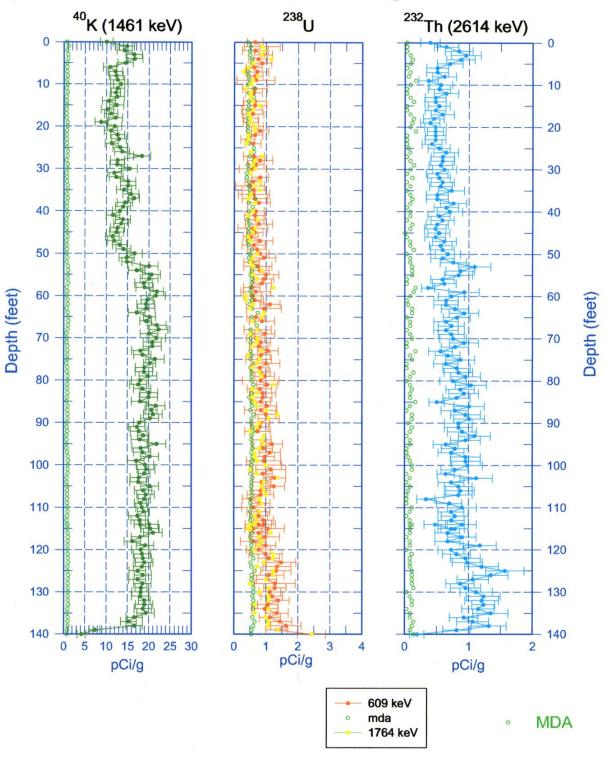
elevated neutron counts per second that occur at about 125 through 140 ft correspond with an interval of relatively high total gamma interpreted as the Early Palouse Soil.

¹ GWL – groundwater level ² TOC – top of casing ³ N/A – not available ⁴ n/a – not applicable

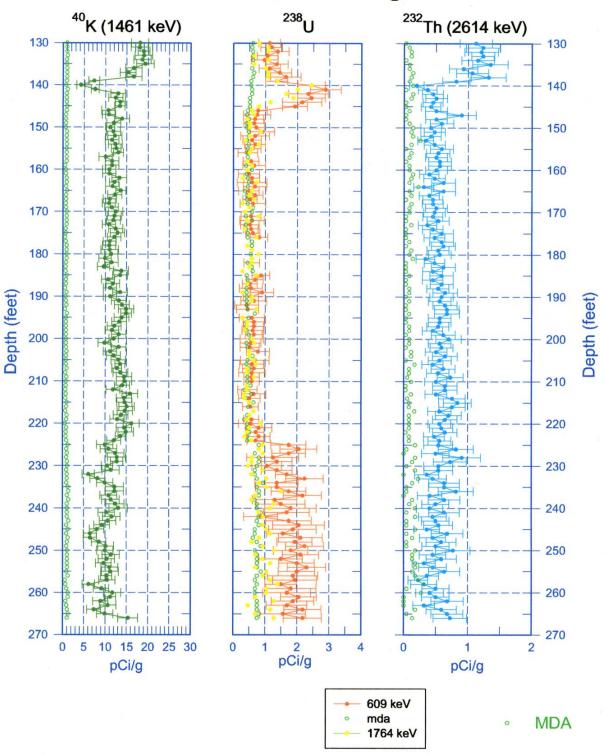
299-W19-45 (C3394) Man-Made Radionuclide Concentrations ¹³⁷ Cs (662 keV)



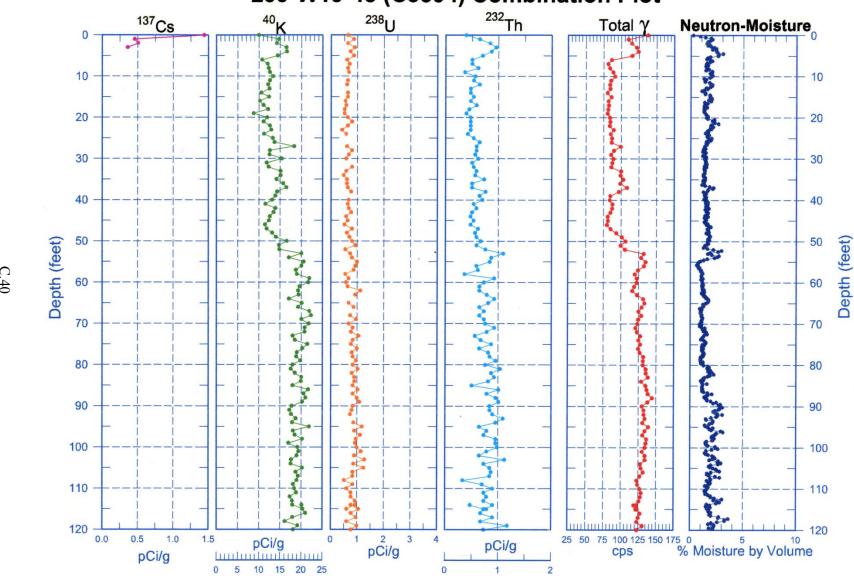
299-W19-45 (C3394) Natural Gamma Logs



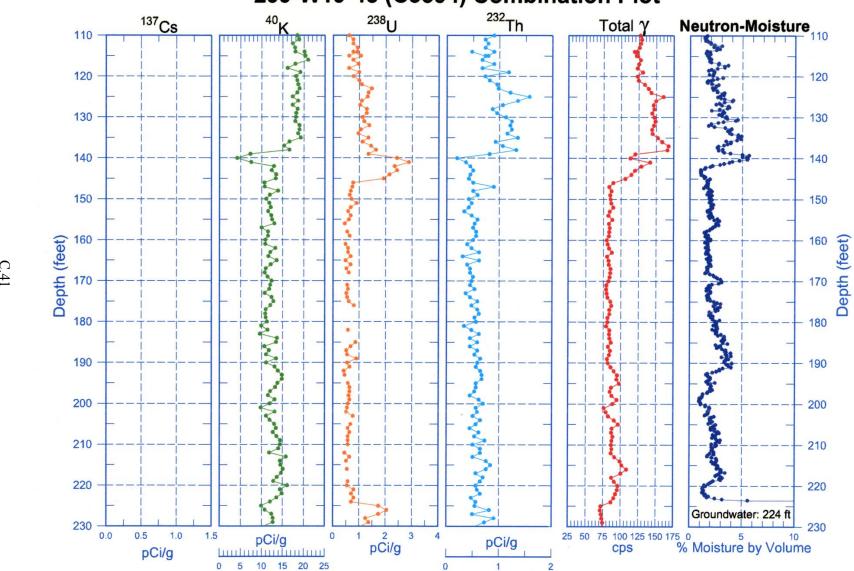
299-W19-45 (C3394) Natural Gamma Logs



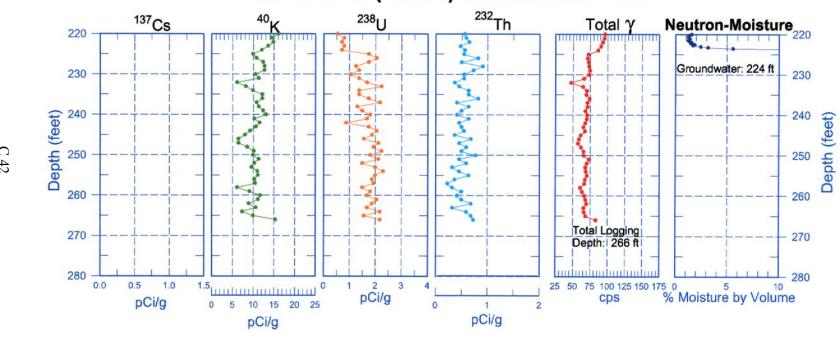
299-W19-45 (C3394) Combination Plot

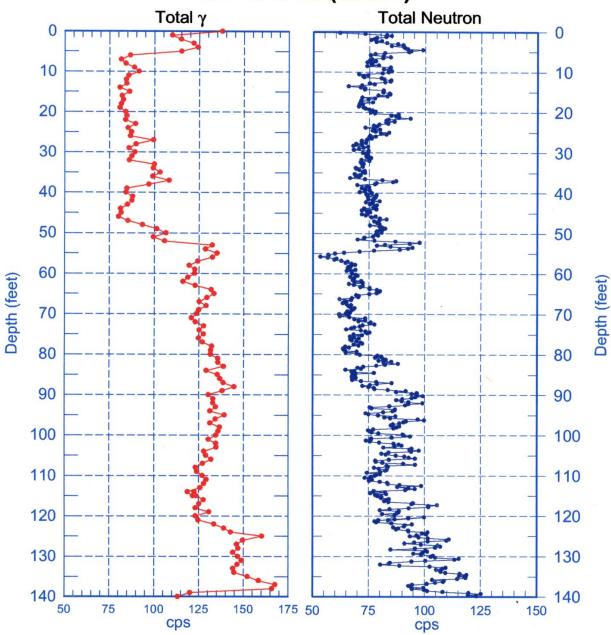


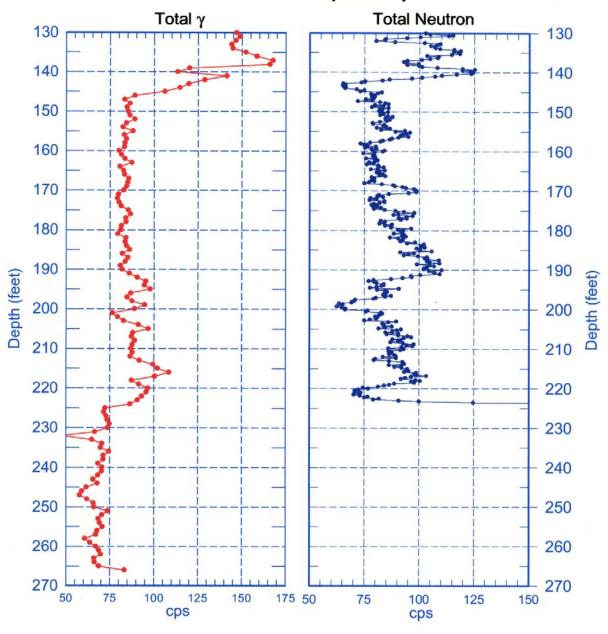
299-W19-45 (C3394) Combination Plot

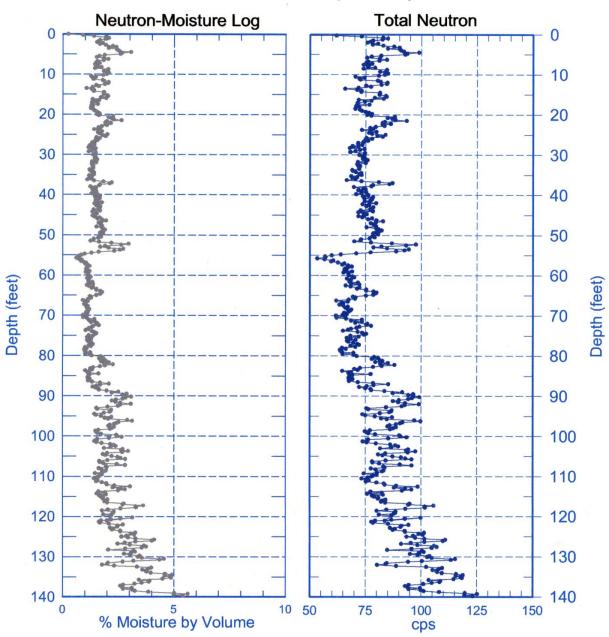


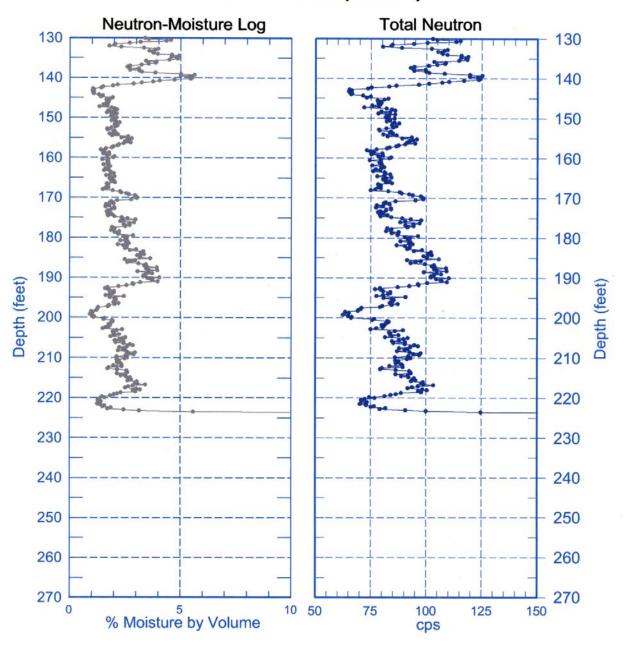
299-W19-45 (C3394) Combination Plot



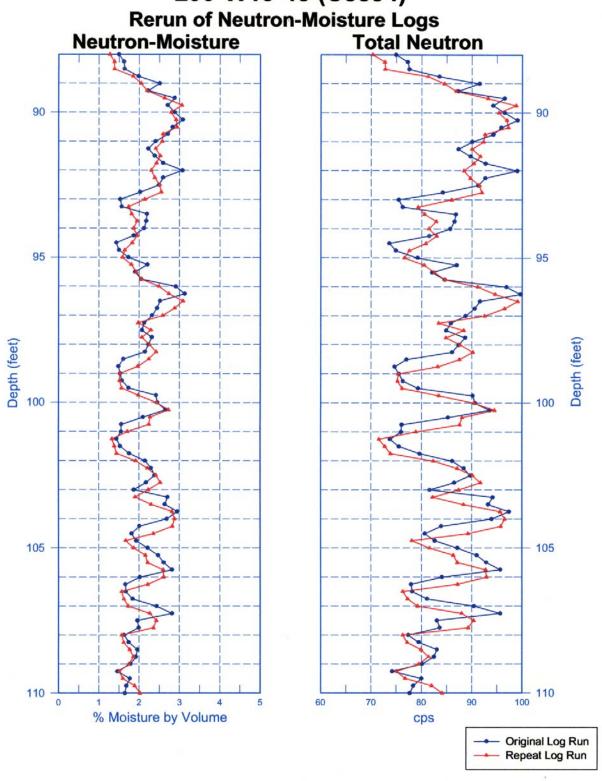






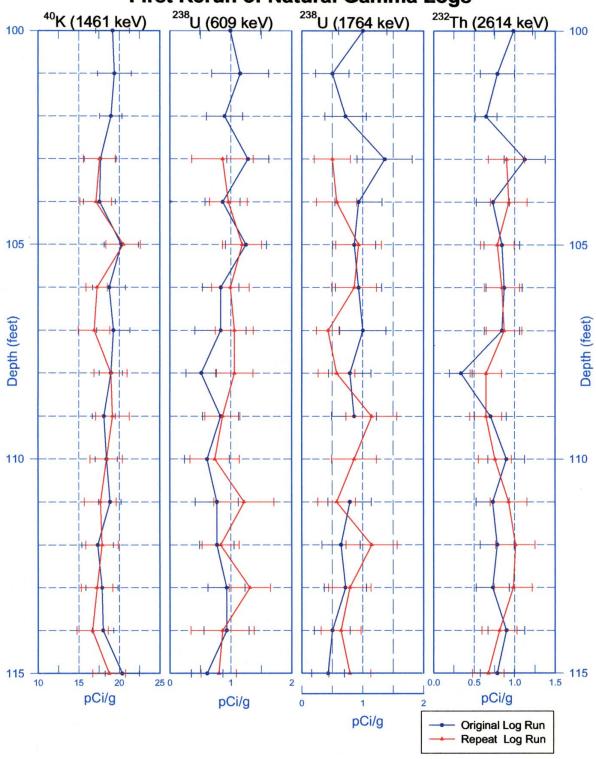


299-W19-45 (C3394)

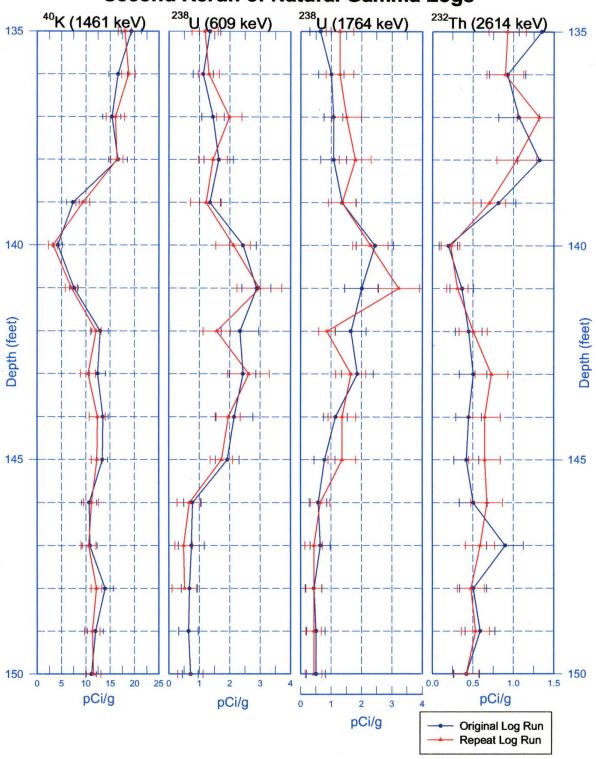


299-W19-45 (C3394)

First Rerun of Natural Gamma Logs



299-W19-45 (C3394) Second Rerun of Natural Gamma Logs



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	30 "C" Street S.W.				
	P.O. Box 878		14	Pacific Northwest National Labo	ratory
	Ephrata, WA 98823			E. P. Dresel	K9-96
	P. Sobotta			D. G. Horton (3)	K6-81
	Nez Perce Tribe			S. P. Luttrell	K6-96
	Environmental Restoration/Waste			W. J. Martin	K6-81
	Management			R. M. Smith (3)	K6-96
	P.O. Box 365			F. A. Spane	K6-96
	Lapwai, ID 83540-0365			D. Vela	K6-96
				B. A. Williams	K6-81
OI	NSITE			Hanford Technical Library (2)	P8-55
3	DOE Richland Operations Office				
	M. J. Furman (2)	A5-13			
	R. M. Yasek	H6-60			